



# Original Instructions

ECE UK Ltd Air Handling  
Units, Installation &  
Operation Manual. 2013.

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This manual contains advice for installers and users.

General information about the range, construction and selection of ECE air handling/conditioning equipment can be obtained from the various sales publications, or by telephone.

Certified individual unit data concerning dimensions, weights, component specification and performance, is issued with the order acknowledgement for each unit.

Due to our policy of continuous improvement the information contained within this manual may be altered from time to time without prior notice.

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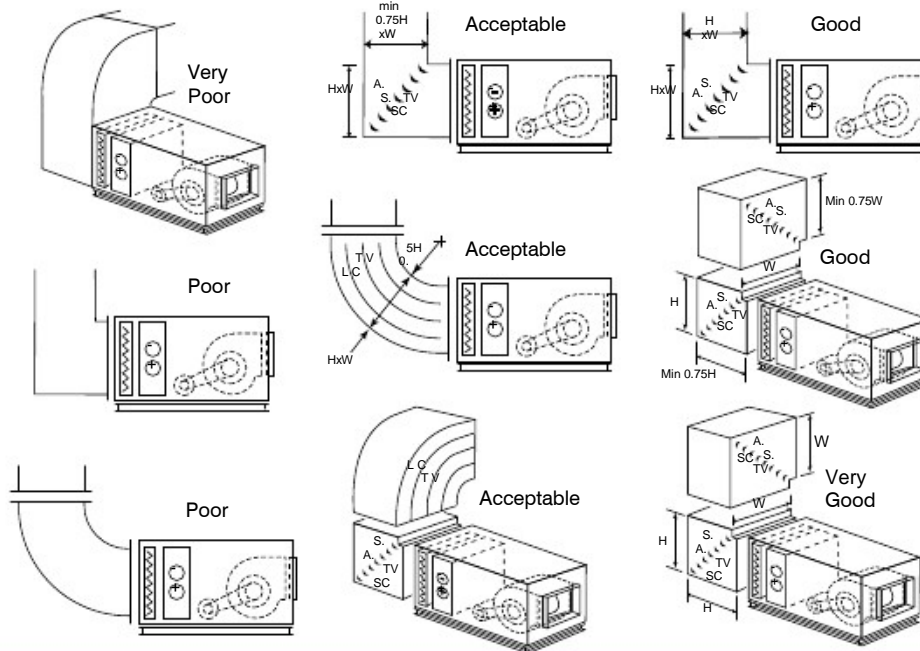
## 1. Checks at Design Stage

### 1.1. Air Inlets and Discharges

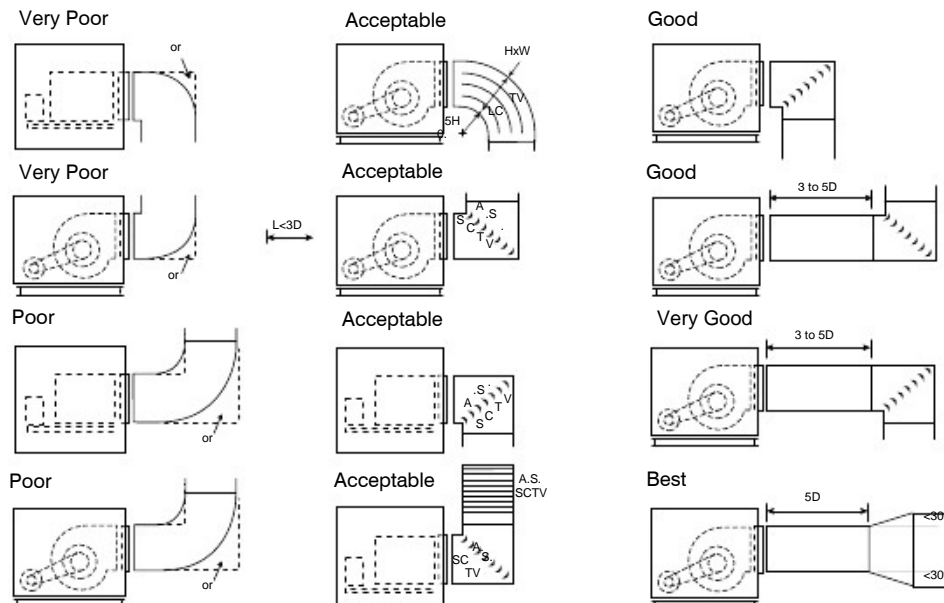
Whether ducted, or part of the Air Handling Unit, inlet and discharge connections to atmosphere such as Louvres, cowls, spigots etc. should be located and dimensioned so that flow restriction, short circulating, Recirculation of vitiated air, pick up of contaminated air or nuisance discharge of exhaust air do not occur.

Ducted intakes and discharges to units should be designed and constructed to ensure that flow restriction, turbulence, pre rotation, jetting, uneven velocity profile and surface or object excitation do not occur.

Poor intake design causes uneven velocity profile across unit components resulting in moisture carryover hence flooding, design supply air conditions not being achieved, electric heater elements overheating, DX refrigerant cooling coils freezing and secondary generation of noise and vibration etc.



Poor discharge design causes reduction in fan pressure and volume, also turbulence generating secondary noise and vibration, which may reduce impeller, bearing, vibration isolator and flexible connection life. Design supply conditions may not be achieved. Electric elements may overheat. DX coils may freeze.



A.S. SCTV = Aerofoil Section Short Cord Turning Vane 50mm ctrs.  
LCTV = Long Cord Turning Vanes to HEVAC - CIBSE - ASHRAE Standards

D = Fan inlet eye diameter

## 1. Checks at Design Stage

### 1.2. Acoustics - Vibration

Ensure space exists for incorporating attenuation of noise to atmosphere from outside air inlet and exhaust air discharge and on room side supply and extract ducts.  
Consider noise from casing radiation, flanking and breakout.  
Consider primary and secondary vibration isolation including service connections.

### 1.3. Services - Connections

Ensure space with clearance exists for access to, routing of, connection to and expansion and contraction of water, steam, refrigerant, gas, oil supplies and line fittings. Combustion air supply, flue gas exhaust. venting of air, Isolating and draining of plant, trapping and returning steam, condensate, trapping and draining of condense from cooling coils, humidifiers and heat recovery devices to open tundish, blowing down waste to open tundish, pumping down and storing of refrigerant, power - control wiring, and components.

### 1.4. Commissioning & Fault finding

Ensure plant is designed to allow installation of and access to calibration and adjustment of measuring and modulating devices for:-

Air flow direction and rate. Medium flow direction and rate.

Resistance to airflow. Resistance to medium flow.

Air on and off dry bulb, wet bulb and humidity. Medium on and off pressure and temperature.

Ensure space exists in and around the plant for access to, inspection of, measuring of and work on items including:-

Belt tensioning of external motors.

Jacking and levelling of steel spring vibration isolators.

Clear sight of identifying labels measuring and recording devices.

VCD blades, links and actuators, humidifier generators, sparge pipes, coil and eliminator surfaces and drain pans, electric heaters, fan and drives.

Fan speed and direction of rotation.

Belt tension.

Motor speed and direction of rotation.

Motor current, resistance, continuity.

Motor nameplate.

Terminal wiring diagrams.

Wiring.

### 1.5. Maintenance Repair and Renewal

For units with one piece coils ensure space exists of at least one unit width plus 150mm on the withdrawal side of each plant item. for units with split coils ensure at least half the width of unit or 700 mm whichever is greater.

Adjacent units can share the common space between them for access and withdrawal.

Ensure room exists for safe working platforms where units are mounted at high level.

Ensure provision exists for steps, ladders etc. where units are over 1750 high or mounted on platforms which elevate the unit height and make access difficult.

### 1.6. General

Any or all of the following and their effect on the plant should be considered and the appropriate action taken:-

Conditions within surrounding areas.

External temperature and humidity.

Direct solar radiation.

Wind speed and direction.

Driven rain.

Driven snow.

Driven sand.

Sea spray, mist, fog, moisture in suspension.

Saline atmosphere.

Icing.

Unit surface temperatures and surrounding air dew point.

Gases which form acids in solution in water Such as SO<sub>2</sub>.

Flammability.

Explosion risk.

Toxicity.

Bacteria.

Fungi.

Algae.

## 2. Checks at Order Stage

### GENERAL INFORMATION

DATE.  
TIME.  
CONTACT(S).  
COMPANY.  
ADDRESS.  
PHONE NO.  
FAX NO.

### CONTRACT INFORMATION

CUSTOMER REF. No.  
CONFIDENTIAL? JOB NAME.  
DELIVERY AREA.  
SPECIFICATION PAGES.  
OTHER STANDARDS REFERRED TO IN SPECI.  
DRAWING NO's.  
SCHEDULE REFERENCE.  
OTHER CUSTOMER DOCUMENTS.

### UNIT INFORMATION

ITEM No.  
AREA REF.  
No. OFF.  
SUPPLY/EXTRACT.  
INT/EXT/ROOF/FITTED WORKS OR SITE.  
PART/HORIZ.  
PART/VERT.  
CONFIGURATION/SKETCH .  
25mm - 50mm PANELS.

### EXTERNAL SYSTEM RESISTANCE.

DEPRESSION AT UNIT INLET.  
POSITIVE AT FAN DISCHARGE.  
PRESSURISED SEP/MIX BOX/PLENUM.  
DIFFUSION/BLANKING SCREEN?  
INLET POSITION.  
DISCHARGE POSITION.  
ONE-TWO-DUPLEX-TRIPLEX.  
DIDW - SISW.  
FC/BC.  
BD/DD.  
RAFT/RIGID.  
I.G.V. + CONTROLLER.  
NRD's ONE. TWO.  
GUARDS:-  
INLET/EYES/DISCH/DRIVE.

### DRIVES

MOTORS INT/EXT.  
DUTY/IDLING.  
PULLIES/BELTS/IN/OUT/AIR STREAM.  
1 SPEED/2 SPEED/VARIABLE SPEED.  
SPD CHANGE INTERLOCK WITH EAHB.  
POLE CHANGE/DUAL WOUND.  
ELECTROMAGNETIC CLUTCH (TASC)  
SWITCHED RELUCTANCE.  
INVERTER.  
DOL/SD.  
ST'D/FLFI  
ELEC SUPPLY.  
FLOOR GRID.  
LIFTING BEAMS.

### FILTERS

PRESTI.STIL.  
AFTER ST.J.11.111.  
TO EXTRACT HEAT RECOVERY.  
GREASE TO KITCHEN EXTRACT.  
TYPE.  
EFFICIENCY BY WEIGHT.  
EFFICIENCY SPOT DUST.  
RETENTIVITY (ACT.CARBON).  
BS.ASHRAE.EUROVENT.  
WITHDRAWAL- SIDE/US/DS/T/B.  
FITTED MANOMETER(S).  
MAGNAHELIC(S).  
RADIANT HEAT FROM EAHB.

### INLETS AND DISCHARGES.

LOUVRES/FAI/DTA/STD/ACOUSTIC.  
ELMTRS + DRAIN HIGH VELOCITY  
FAN DISCHARGE 45° SPIGOT + MESH.

### SEPARATION/MIXING BOXES/VCD'S

INT/EXT DAMPERS.  
FAI/RC/DTA POSITION.  
OPP/PAR/MAN/MOTOR/BELIMO.

### VOLUME CONTROL

100%/ZONE/F & BP/LOCATION.  
INT/EXT.  
OPP/PAR/MAN/MOTOR .  
CONSTRUCTION GSS.

### HEATING/COOLING

HEAT RECOVERY  
HEAT REJECTION  
DEHUMIDIFYING  
HUMIDIFYING  
POSITION/TYPE.  
DRAW THROUGH/BLOW THROUGH.  
VOLUME m/s.  
AIR ON CWB/DB/kg/kg.  
AIR OFF CWB/DB/kg/kg.  
SWEATING INS FRAME.  
DX + CONST OFF = FREEZE.  
HUMID POSN ADJ SURFACES - WETTING.  
CLEAR DISTANCE DOWNSTREAM.  
GAS HEATER.CONDENSATION - BYPASS.  
COMBSTN AIR INLET-FLUE OUTUT. POSN.  
LOAD/EFF/OUTPUT.  
STEPS/INTERLACED/FACE .  
MEDIUM TYPE.  
FLOW/RETURN °C.  
EVAP. TEMP °C.  
PRESSURE - BAR/Kpa.  
GLYCOL %.  
OUTSIDE AMBIENT,  
COND.TEMP C.  
ELEC SUPPLY.  
EAHB MIN AIR FLOW SPEED.  
EAHB BALANCED ACROSS 3PH SUPPLY.  
INTERLOCK WITH VAR. SP. FAN.  
CONSTRUCTION.  
PLATES/TUBES/FINS.  
ELEMENTS/BURNER/INFILL.  
FINISH:- SELF/VINYL/ET.  
FREE COOLING & MECHANICAL TOP UP.  
AIR ENTERING AT 90° TO COIL FACE.  
FACE VELOCITY PROFILE.  
CONDENSATE DRAIN PROVISION - HEIGHT  
PLENUMS  
LOCATION/FUNCTION .  
DIFFUSER/SPACER/ACCESS.  
90°/HORIZ/VERT.  
TO/FROM:- ABOVE/BELOW/LHS/RHS.  
HINGED/LIFT OFF.  
TOOL OP/HANDLES/LOCK TO ONE HANDLE.  
VIEWPORT(S).  
BULKHEAD LIGHT(S) EXT SWITCH.  
WIRING BY OTHERS.  
FLOOR GRIDS.

### INLET/DISCHARGES

FROM:- ABOVE/BELOW/LHS/RHS/FACE.  
LOUVRE/SPIGOT.  
STACK & COWL.  
90° + SCTV.  
GRILLE/SD/DD/NV/OBD's.  
CONSTRUCTION.  
FINISH.

### VIBRATION ISOLATORS

INT/EXT.  
EFF REQUIRED %.  
RUBBER IN SHEAR/STEEL SPRING.  
JACKING.  
SELF LEVELLING.  
FIXED/LOOSE.

### FLEXIBLES

ISOLATING/FAN RAFT/FAN SECTION.  
COMPUTE UNIT/PIPE CONNECTIONS.  
ATTENUATING.  
FLAME RESISTANT.  
CONSTRUCTION.  
FINISH.

### ATTENUATORS

EXTRACT/ATMOS/ROOM SIDE/ZONE.  
SUPPLY/ATMOS/ROOM SIDE/ZONE.  
TO ACHIEVE NR IN/AT.  
UNIT/DUCT MOUNTED.  
STRAIGHT /90 + SCTV.  
VOLUME m/s.  
INLET/OUTLET PLENUM/LENGTH.  
FROM/TO/ABOVE/BELOW/LHS/RHS/FACE.  
FINISH.  
BREAKOUT.  
FLANKING .

### ANCILLARIES

50 x 100 x 50 FULL PERIMETER BASE.  
6MM ANODISED ALUMINIUM.  
3MM GSS.  
INTEGRAL LUGS.  
SUPPORT LEGS.  
SUPPORT STEELWORK.  
SIDE/CENTRAL/SERVICES CORRIDORS.  
PIPEWORK.  
CONTROLS.  
WIRING.  
ACCESS PLATFORMS.

### CONSTRUCTION

FRAME/GSS/ALI/PLASTISOL.  
OUTER PANELS/GSS/PLASTISOL.  
INNER SKIN/GSS/PLASTISOL/ST. ST.  
INSULATION/25mm/50mm/65kg/m<sup>3</sup>.

### FINISH

LOCATION EXT/INT.  
ANODISED ALI.  
PLASTISOL.  
GSS SELF.

### PROTECTION

POLYSTYRENE CORNERS  
CLING FILM WRAP  
POLYSTYRENE BOARDS  
REWRAPPED AFTER ASSEMBLY.

### SITE COSTS

SITE SUPERVISION WORK REQUIRED.  
SITE ASSEMBLY REQUIRED  
SAFETY CHECKS I.E. GAS HEATERS  
GUARANTEE CHECKS  
I.E. ASSEMBLY STANDARDS. WEATHERING  
AND SITE AIR LEAKAGE STANDARDS.

### PROBLEMS

TRANSPORT:- LOADED VEHICLE OBSTACLE  
CLEARANCE/ROUTE LOAD BEARING.  
ROAD CLOSURE/STAT PERMISSIONS  
ONLOADING/OFFLOADING. CRANE/FORK  
LIFT.  
WEIGHT/CAPACITY.  
MOVING ON SITE:- ROUTE/LOADS/METHOD/  
BUILDING LOAD BEARING.  
MAX SIZE/WEIGHT PER PIECE FOR ACCESS  
DRY STORAGE BEFORE ERECTION  
BASES:- LEVEL/LOAD BRG/RELEVELLING  
DEVS  
BOLTING ADJACENT SECTIONS ON SITE  
I.E. HEATING & COOLING COILS.  
ACCESS/MAINTENANCE/WITHDRAWAL PLANT.  
SUN/WIND/RAIN/SNOW.  
SALINE/ICING.  
DUST/POWDER/GRIT/SOOT/SMOKE/SAND.  
TALL UNITS ON PLINTHS SIDE WALKWAY?  
ARE TOP ACCESS DOOR CATCHES IN  
REACH?  
CONTAINMENT & DRAINAGE OF LEAKS.  
SLOPING, DIFFERENTIAL TRAPPED  
CONDENSE DRAINS, TO OPEN TUNDISH.  
MISWIRING MOTORS COMPETENT  
ELECTRICIAN.

### TIME SCALE FOR ACTION

JOB POSN/CUST POSN/ECE POSN  
PRELIM. DSGN?/FINAL DSGN?/BUDGET?  
QUOTE REQUIRED BY  
IF ECE SPECIFIED. WHEN?  
OUT TO TENDER BY.  
RETURN DATE  
ORDER TO ECE CUSTOMER BY  
IF ECE SELECTED. WHEN?  
ORDERS TO ECE BY  
DELIVERY DATE(S) REQUIRED  
GUARANTEE PERIOD REQUIRED FROM.  
FOB/CIF/PACKED FOR SHIPPING  
CONDITIONS OF TRADING  
CREDIT RATING IF APPLICABLE.

### 3. Delivery

#### 3.1. Receipt & Unpacking

Units are designed and manufactured according to ISO 9001

As part of our quality control system each unit undergoes a full pre-delivery inspection before loading.

Units are then fitted with corner protection and wrapped in polythene to prevent ingress of foreign bodies or water during transportation.

All units are fitted with a full perimeter bases to facilitate lifting, moving and installation.



Unit wrapped ready for dispatch

Units should be inspected and any external damage or short delivery reported to ECE, **before unloading**.

We cannot accept responsibility for damage sustained during unloading from the delivery vehicle or on site.

All claims for internal defects or short delivery must be reported immediately and confirmed in writing.

Units must be off loaded, lifted and lowered using long lifting straps and timber blocks or using an 'H' Frame with short lifting straps and timber blocks or a fork lift with extended forks.

Units must be moved across site using a fork lift with extended forks, multiple solid rollers or skates.

Final lowering and side shifting to bring parallel faces together should be by toe jacks with timber blocks

Internal joining bolts should never be used to pull modules together.

Modules should never be rolled over to move across site

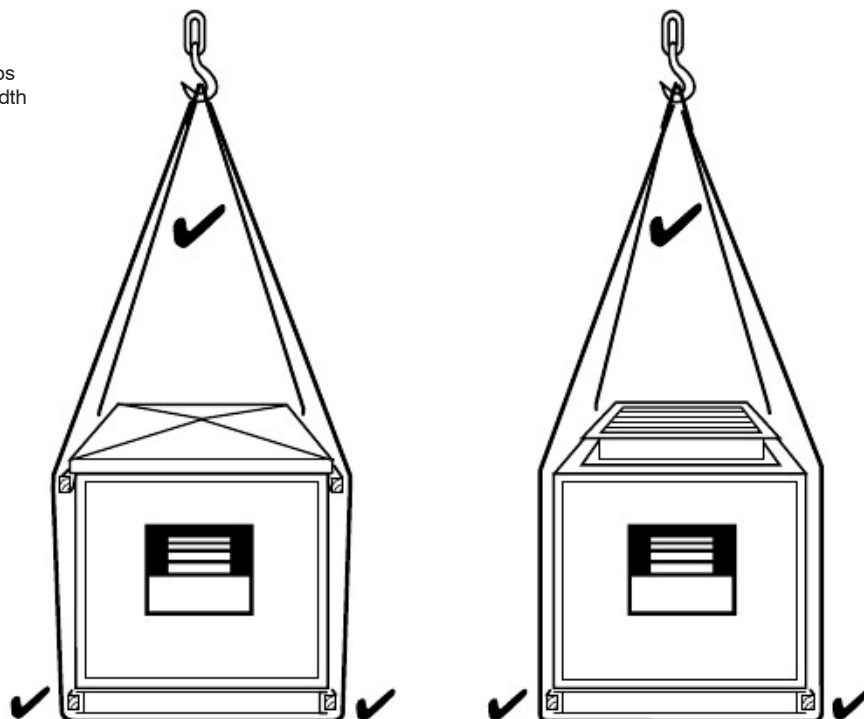
Guidance notes for unloading and handling are given in the following pages.

Before commissioning all packaging materials must be removed from the units and cleared from the area.

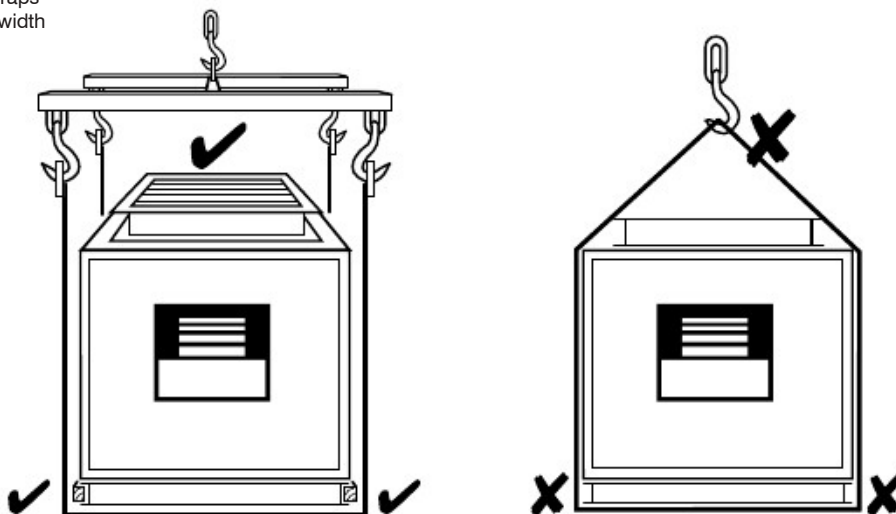
## 3. Delivery

### 3.2 Lifting

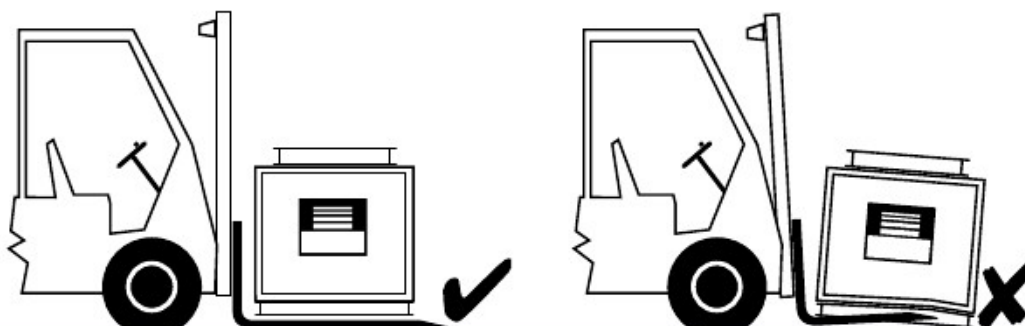
- 3.2.1. Crane  
long lifting straps  
150mm min. width



- 3.2.2 Crane  
'H' frame  
short lifting straps  
150mm min. width



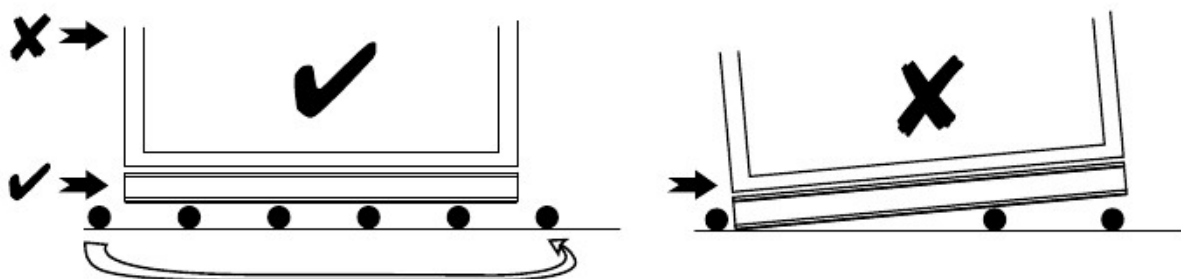
- 3.2.3 Fork lift



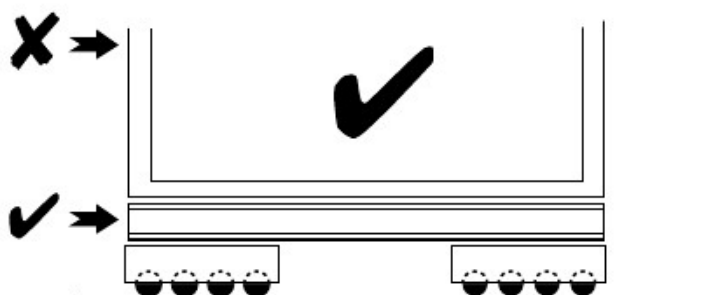
### 3. Delivery

#### 3.3. Moving

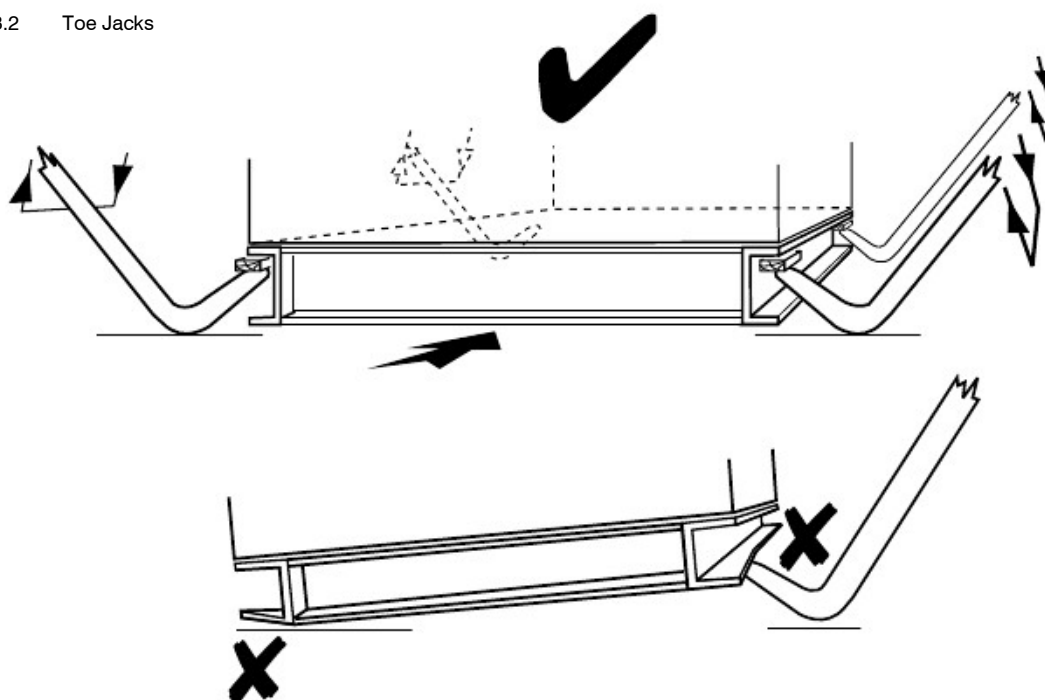
##### 3.3.1. Rollers



##### 3.3.3 Skates



##### 3.3.2 Toe Jacks



## 4. Installation

### 4.1. General

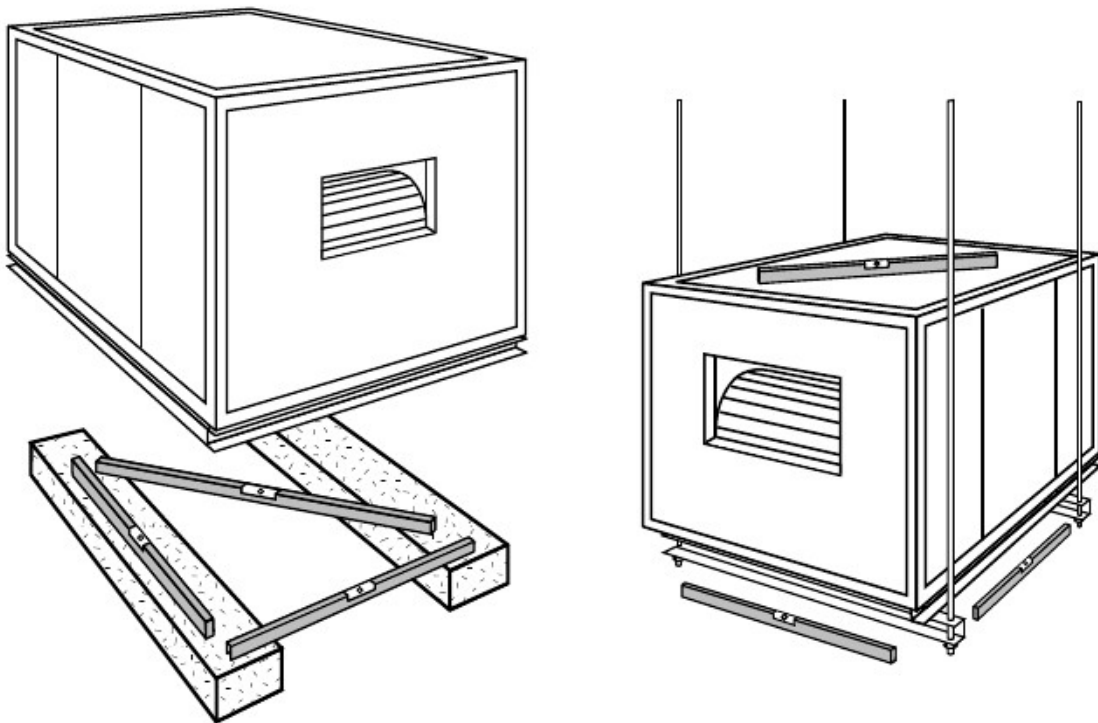
Electrical wiring and controls, water, steam, gas and refrigerant piping, line fittings and controls should be installed in accordance with appropriate governing institute standard practice (I.E.E., C.I.B.S.E. etc.) and together with the electricity supply, water supply and drains should conform to the appropriate authority and all statutory regulations.

Units with drains should be mounted at a level which allows installation of cleanable drain traps at each connecting point then installation of drain pipework falling to an open tundish.

Space should exist for the application of sealant - jointing rubbers. Tightening of internal fixings. Internal installation, attachment or insertion of isolating, indicating, recording, modulating, activating, devices, also making and tightening of fixings at connections to air Inlet and discharge ducts.

### 4.2. Bases and foundations

All units must be installed on a permanent prepared base which must be firm, level and structurally rigid. Units may be mounted on suitable steels or purpose built C.I. frames supported from the main roof structure providing this is capable of supporting the weight - see Checks at Design Stage.



#### Note:-

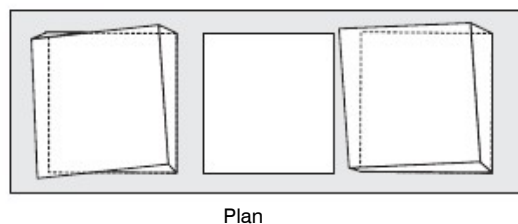
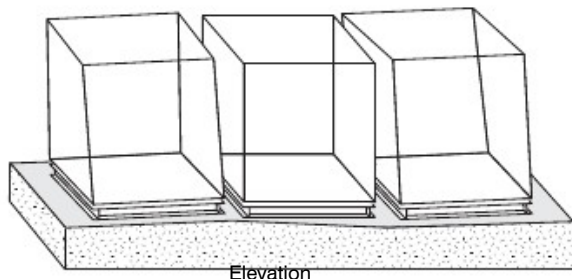
The use of TICO material to dampen vibration / noise is not recommended as it will cause uneven deflection due to variations in point loading within units. This will cause vertical joints to go 'out of parallel' causing leakage at joints.

## 4. Installation

### 4.2. Bases and foundations (cont'd)

When foundations are uneven units will 'lozenge' if the installer attempts to use the joining bolts to pull non parallel faces together causing air leakage at joins, access doors will jam and not close after opening and duct connections will not be 'parallel' and will leak.

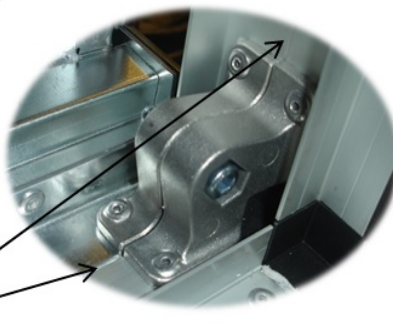
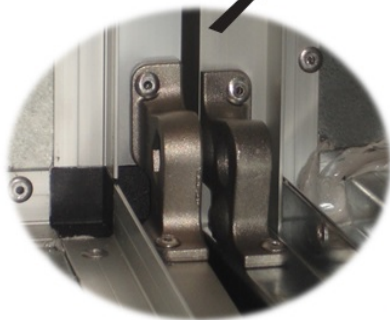
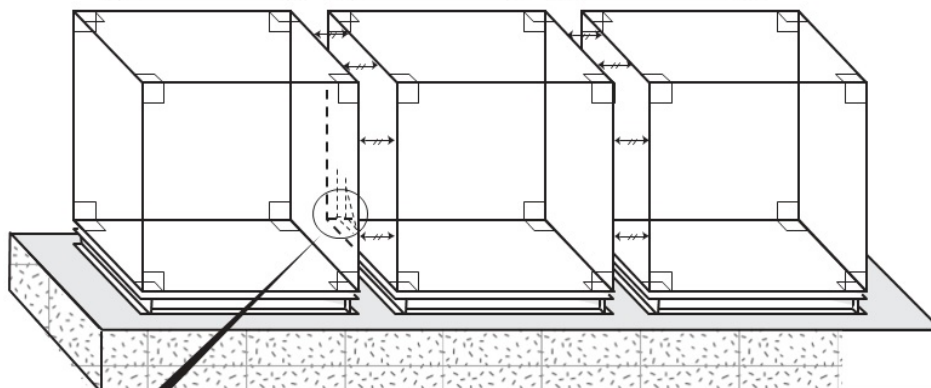
Uneven Base - units 'lozenged'



When foundations are level and perfectly flat units will be perfect cubes and will fit together squarely with good air seals, access doors will open and close correctly and duct connection are air tight.

Do not use joining bolts to pull units together in elevation or in plan.

Level Base -  
units perfect cubes



Thin mastic seal

## 5. Commissioning

### 5.1. Commissioning Fans - Motors - Drives

Access is by hinged or lift off panels. Catches are hidden quarter turn cams, tool or key operated.

Wiring to the motor(s) should be carried in flexible armoured conduit through screwed gland(s) fitted in hole(s) drilled by the installer/user. NEVER THROUGH ACCESS DOORS.

Motors may be 240/1/50 or 415/3/50 TEFC, flameproof, super silent, single speed, dual speed, regulative or non regulative, D.O.L. or Star Delta. DO NOT attempt to wire the motor without reference to the correct wiring diagram issued with the unit.

Starters MUST have thermal overload cut outs and single phasing prevention devices.

#### Belt Drives

Slacken belt tensioner, remove belts, check impeller rotates freely and fan scroll is free of obstructions.

Remove locking bolts and shipping braces, if fitted, to protect vibration isolators during transport.

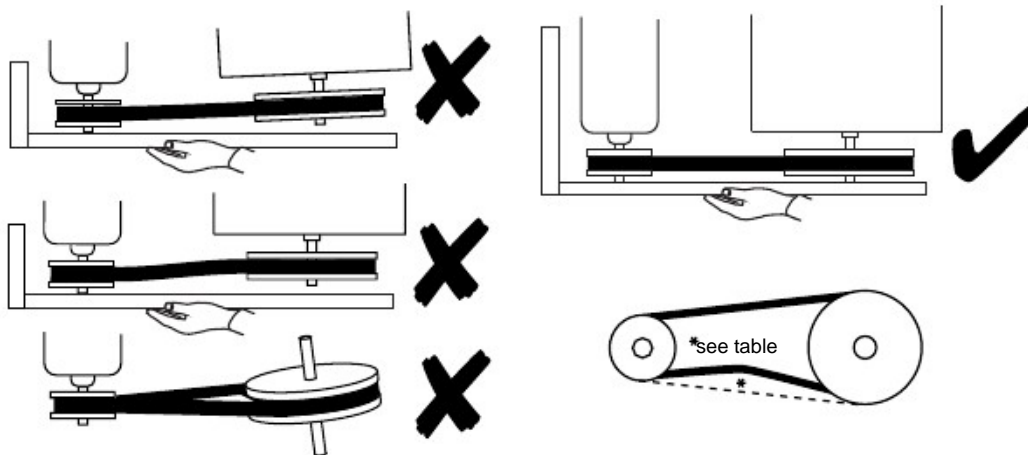
Adjust jacking self leveling steel spring vibration isolators as instructions until floating and damped.

Check rubber in shear anti-vibration mounts for condition, tightness and free operation - bounce.

Inspect all bolts on motor, fan and frame for tightness.

Test run motor for condition and correct rotation.

Replace belts and check pulleys are correctly aligned as illustrated.



Adjust the belt tension according to the table

The lowest belt tension at which slip does not occur under load gives longest belt and bearing life.

Belt Section		SPZ	SPZ	SPA	SPA	SPB	SPB	SPC	SPC
Small pulley diameter mm	min.	67	100	100	140	160	236	224	375
	max.	95	140	132	200	224	315	355	560
KG force for 16mm* defl'n/metre span	min.	1.0	1.5	2.0	2.8	3.5	5.1	6.1	9.2
	max.	1.5	2.0	2.7	3.5	5.1	6.6	9.2	12.2

With all access panels in place, components installed and the ducting system complete, connected and commissioned, check that measured full load current is less than motor nameplate full load current. Check that starter overload setting is correct and that single phasing protection is functioning. If any problems occur refer to Fault Finding Section of this manual.

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## 5. Commissioning

### 5.1 Commissioning Fans - Motors - Drives cont'd

The complete ductwork system should be proportioned to CIBSE - ASHRAE recommended procedure.  
The Volume should be measured and if outside CIBSE recommendations or specified tolerances then;

Installer / commissioning engineer should submit full commissioning data to ECE.

ECE will calculate new fan speed required to achieve design volume and recommend pulley(s) & belt(s) sizes required to achieve new fan speed.

Installer / commissioning engineer should then:  
purchase new pulleys and belts available locally from nationwide stockists.  
changes pulley(s) & belt(s) on site.  
remeasure volume  
recheck proportion and volumes to air terminal devices.

ECE site operatives are available for changing belts and pulleys on site at extra cost if required.

Notes;

Rotating standby motors generate electricity even when isolated from the mains.  
If the motor is being rotated by the fan DO NOT touch the terminals even if the motor is isolated.

The most common cause of Incorrect fan volume is over estimation of system resistance.  
Please check this before contacting ECE.

Unless specified otherwise fans are belted to give specified volume with clean filters.

Where the specification calls for design volume with dirty filters we recommend the incorporation of pressure activated constant volume control since selection of the fan(s) at final system resistance could result in considerable excess volume initially.

Excess volume can cause:  
coil off temperature, hence room supply air temperature, hence room temperature not being achieved,  
water carryover and flooding,  
motor overload and burnout.  
increased fan noise levels.  
turbulence and excitation of duct walls resulting in noise and vibration problems  
noise regeneration at changes of direction, volume control dampers and air terminal devices.  
reduced filter life.

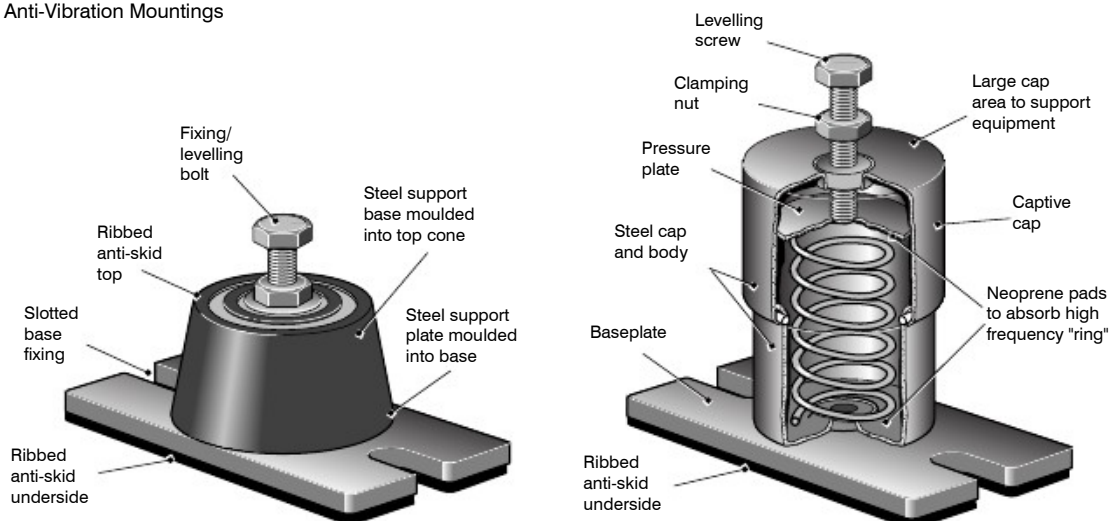
Gross under volume can cause coil sweating, freezing and motor burn out.

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## 5. Commissioning

### 5.1 Commissioning Fans - Motors - Drives cont'd

#### Anti-Vibration Mountings



### 5.11 Checking Label Positioning

Fig 1. Shows the positions of the Danger & Caution labels, these labels will always be positioned on the fan section doors. Should for any reason these labels not be in position they can be obtained from ECE

Fig 2. Shows the positions of the Caution Hot Surface labels, these are positioned on electric heater batteries and gas burners where the surface on the outside of the AHU could be hot and where the inside of the AHU will be **HOT**. Should for any reason these labels not be in position they can be obtained from ECE

Fig 1



Fig 2























## 5. Commissioning

### 5.2. Commissioning - Servicing Filters

Units are supplied with required filters fitted. After installation of the plant "Blow Through". Ensure the system filters are replaced by the installer at commissioning as follows.

Filter Ratings - use this chart to ensure you have the correct type

\*\*If avoidance of pattern staining on surfaces is a priority use this standard or above

TEST METHOD	FILTER TYPE	EUROVENT RATING	ARRESTANCE %	EFFICIENCY %	FILTER REFERENCE (type normally used indicated by bold boxes)		Pa of Normally Used Filters		
							CLEAN	DIRTY	Temp °C
BS EN 779 (1993)	PRE-FILTER PRIMARY EFFICIENCY	EU1	<62	-	 50mm synthetic panel filter	 Metal foil grease filter panels	100	200	50
		EU2	>65 <80	-	 50mm synthetic panel filter	 Fan coil induction filter	100	200	50
		EU3	>80 <90	-	(a)  880mm Standard bag filter	(b)  50mm synthetic panel filter	(a) 50 (b) 100	(a) 250 (b) 200	(a) 100 (b) 50
		EU4	>90	-	 550mm Extra bag filter	 Synthetic Panel filter	87	287	100
	SECONDARY FILTER INTERMEDIATE EFFICIENCY	EU5	-	>40 <60	 550mm Extra bag filter	 Synthetic panel filter	87	287	100
		EU6	-	>60 <80	 900mm fine bag filter	 High efficiency panel filter	137	337	100
		EU7	-	>80 <90	 900mm fine bag filter	 High efficiency panel filter	137	337	100
		EU8	-	>90 <95	 900mm superfine bag filter	 Rigid Pac	287	487	100
	FINAL FILTER HIGH EFFICIENCY	EU10	-	>95	 300mm absolute filter		250	500	120
		EU12	-	>99.97					
		EU13	-	>99.99 <99.997	 300mm absolute filter	 Mini pleat HEPA filter	250	500	120
		EU14	-	>99.9995		 Disposable terminal module			

## 5. Commissioning

### 5.2 Commissioning - Servicing Filters (cont'd.)

Type	Retentivity ka gas / kg carbon	Constant P.d. N/m <sup>2</sup> ins. W.G.	
Activated Carbon	0.1 - 0.4	112	0.45

Remove open side access doors (unless special access).  
 Thoroughly clean system.  
 Install temporary filters (gauze bags etc.) on inlet discharge points.  
 Replace and close access doors.  
 Blow out system.  
 Remove contaminated temporary filters.  
 Replace filters, check sealing for bypass.  
 Replace doors.

Panel filters - Check airflow direction arrows.  
 Absolutes - Ensure pre-filters fitted, check sealing.  
 Autorolls - Check airflow. Autorolls have two end headers, one contains the clean spool, one the dirty spool which is driven by a geared motor and chain drive, activated by a pressure differential switch with 10 seconds delay. Usually a hand inching switch, a media available light and an end of roll indicator are fitted. The 220/1/50 or 415/3/50 motor has starting currents between 1.3 and 7 amps and full load current between 0.3 and 1.5 amps. Motor overload protection should be installed if not already fitted.

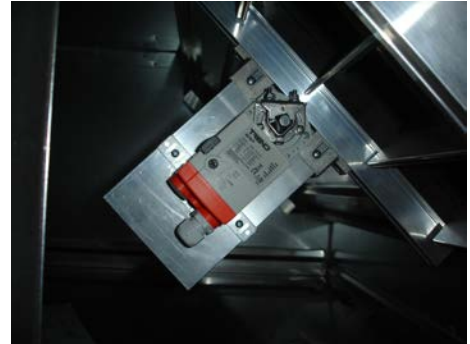
Maximum operating conditions	Continuous	Short period
Glassfibre panels	110°C 80% RH	110°C 80% RH
Soft fibre panels	9°C 80% RH	49°C 80% RH
Autoroll glassfibre	70°C 80% RH	70°C 80% RH
Bag standard	100°C 80% RH	100°C 89% RH
Bag extra fine superfine	100°C 100% RH	100°C 100% RH
Fire resistant panel (BS.2963)	250°C	500°C
Absolute corrosion resistant	66°C 100% RH	120°C
Absolute medium temperature & humidity	70°C 80% RH	120°C
Absolute fire resistant & self extinguishing	250°C 100% RH	500°C

Notes: Always replace media with IDENTICAL media.  
 Install anti-frost control on Autorolls to avoid media roll-on.  
 Install fan run-on control with high temperature heating mediums such as steam or electricity.  
 Pressure switches across filters only indicate blocked filters NOT low airflow due to other reasons e.g. blocked inlets dropped fire dampers.

Install bag or absolute filters after the fan (with discharge plenum) to guarantee efficiency. Pre-filters are still necessary to protect the coils. Activated carbon filters must have coarse and fine pre-filters.

## 5. Commissioning

### 5.3. Commissioning Mixing Boxes - Separation Boxes - Shut off VCD's - HRD's



Hand operated with locking quadrant

check:-

Free action of the damper blades and arm before setting at the required angle.

Motorised (motor not normally by ECE)

Remove links and check:

Motor bolts and platform tight

Electrical supply and connections correct

Motor operates freely and in correct direction.

Dampers move freely.

Reconnect link(s) and adjust for required damper movement and check

Links are not adjusted so that motor attempts to push dampers BEYOND fully open or fully closed position as this can damage motors linkages and bearings.

#### 5.4 Commissioning Coils

##### General checks:

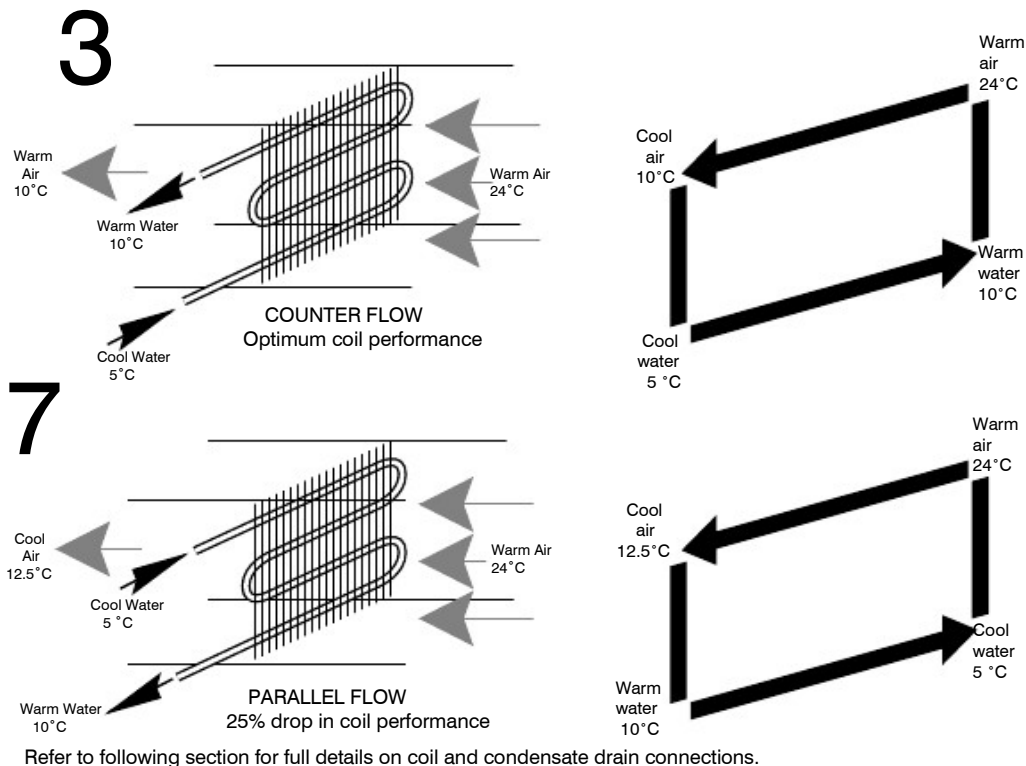
Coils Installed in correct order for psychrometrics.  
Fin conditions, comb out if necessary.

##### Water coil checks:

Air and water are in counter flow.  
Flow pipe work with drain cock fitted is to lowest connection.  
Return pipe work with vent is from highest connection.  
Drains at lowest point, vents at highest point  
Frost protection exists for low ambient airflow or shut down conditions.

##### Coil Connections.

Ensure connections to coils are bottom inlet and top outlet, this arrangement ensures thermal siphoning aids flow. Performance will be limited if these connections are made the wrong way.



Refer to following section for full details on coil and condensate drain connections.

##### Setting Water Flow Through Coils

Open all manual valves fully - including the bypass valve on the three port control valves diverting port.

Ensure that the three port control valve is set to pass 100% flow through the air handling unit coil.

With the aid of a screwdriver open the two small inbuilt valves either side of the flow indicator window on the main commissioning unit. The main commissioning unit is sited in the main return pipe. (these small valves allow water to pass through the indicator window to enable flow rate to be observed).

Set the flow rate through the coil by rotating the larger valve on the main commissioning unit to restrict the water flow until the desired flow rate is indicated in the window. Once this valve has been set DO NOT adjust it again.

Move the three port control valve into the 100% bypass position.

Slowly close the secondary commissioning valve (sited on the three port control valves bypass port) at the same time observe the flow rate being indicated in the window of the main commissioning valve. Continue closing this valve until the same flow rate reading as before is obtained.

Conclude by closing the two small integral valves either side of the indicator window on the main commissioning valve.

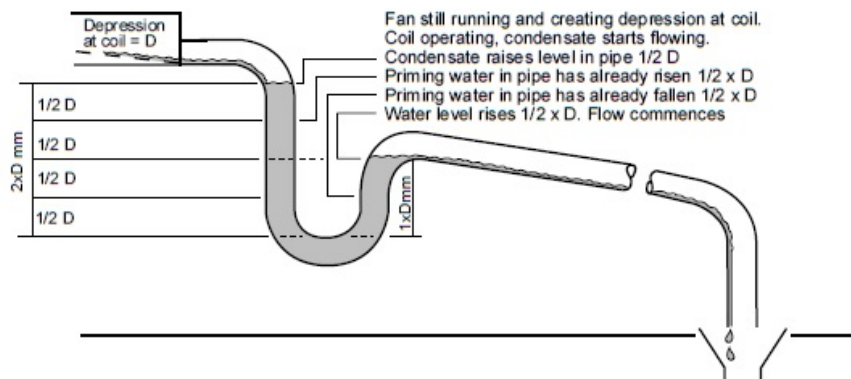
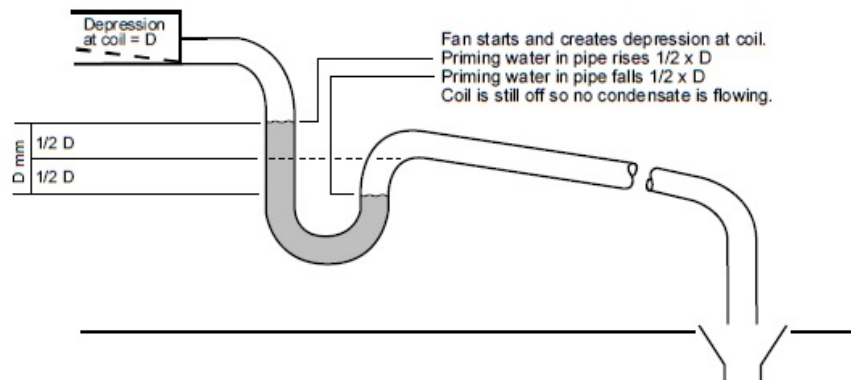
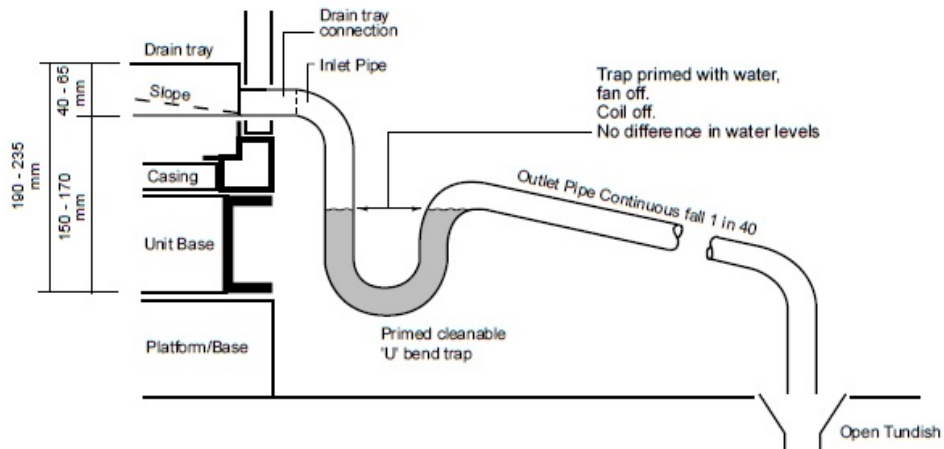
THE SYSTEM IS NOW BALANCED.

## 5. Commissioning

### 5.5 Commissioning Coils - Condensate Drains

Draw through units

Blow through units with negative pressure - depression at trap

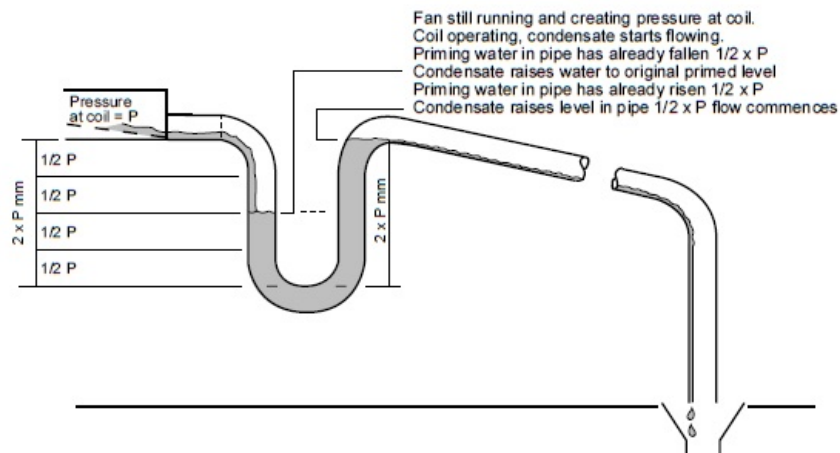
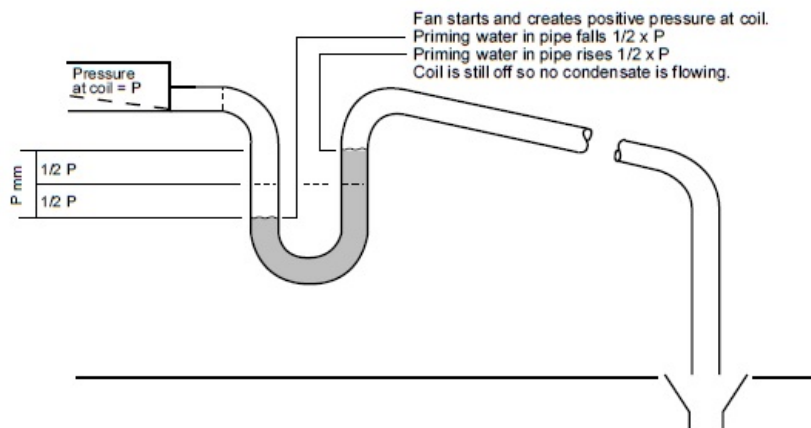
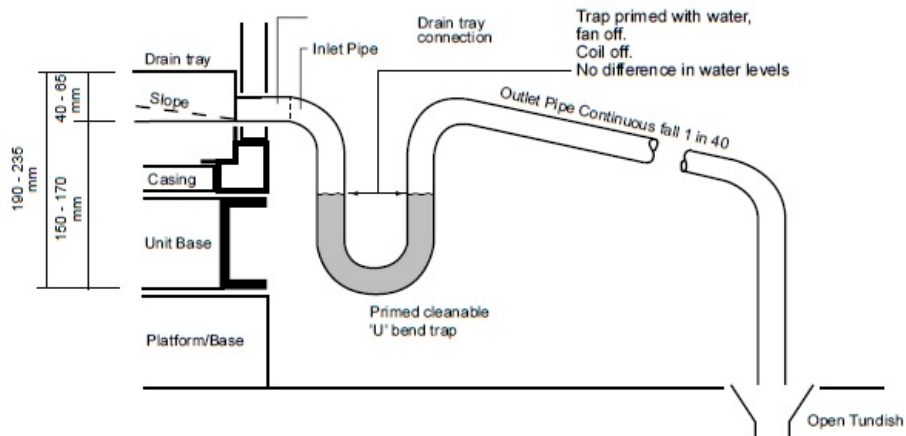


10 pa difference in pressure = 1mm difference in water level i.e. 190mm = 1900 pa depression - 235mm = 2350 pa depression

## 5. Commissioning

### 5.5 Commissioning Coils - Condensate Drains

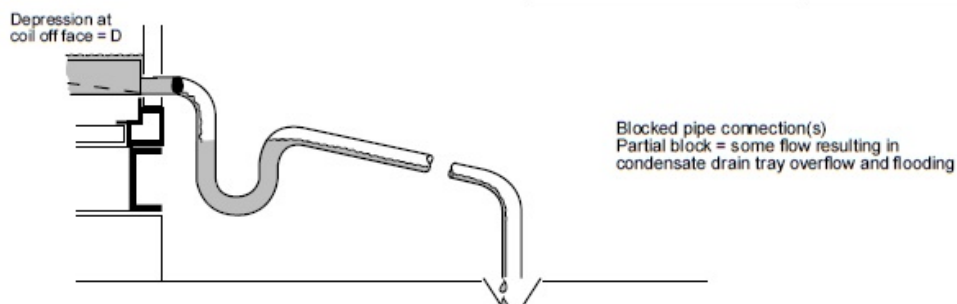
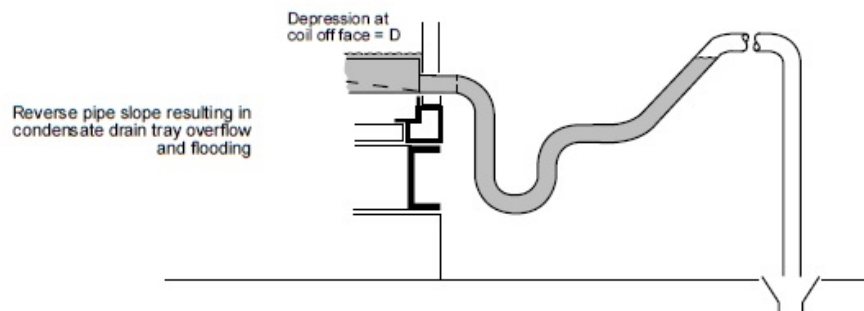
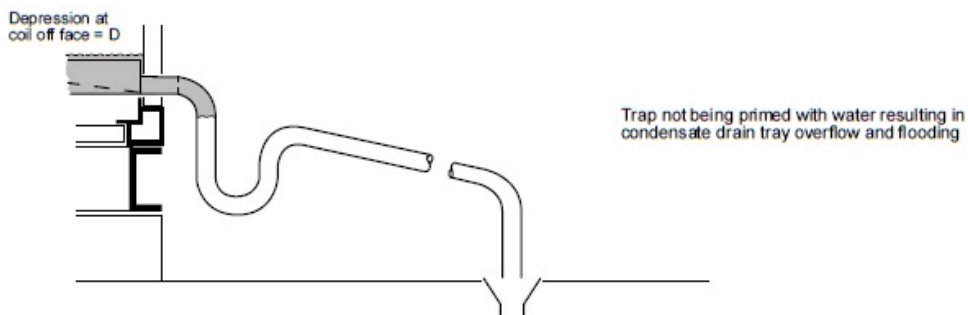
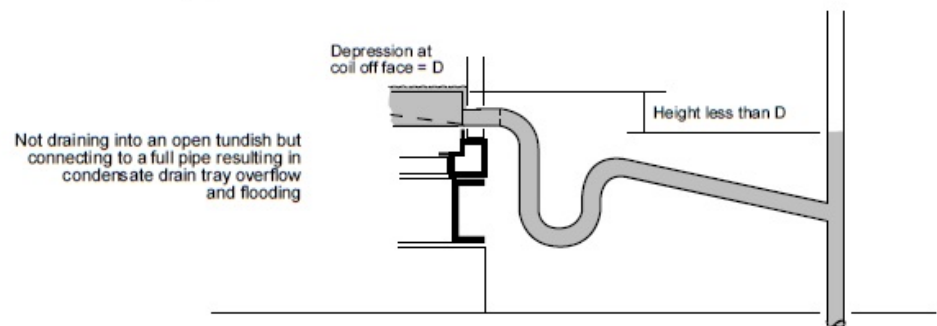
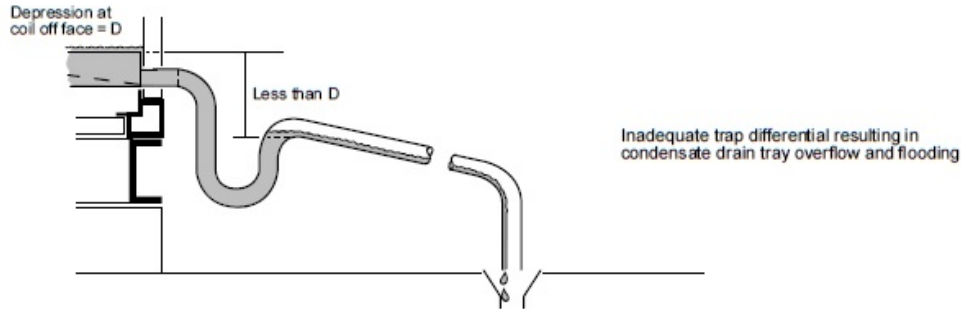
Blow through units with positive pressure at trap



10 pa difference in pressure = 1mm difference in water level i.e. 190mm = 1900 pa depression - 235mm = 2350 pa depression

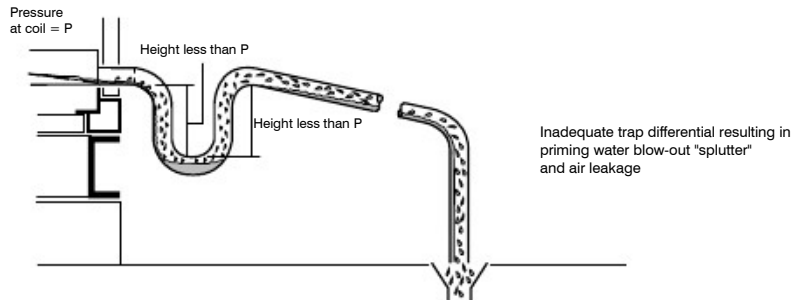
## 5.5 Commissioning Coils - Condensate Drain Faults

Draw through

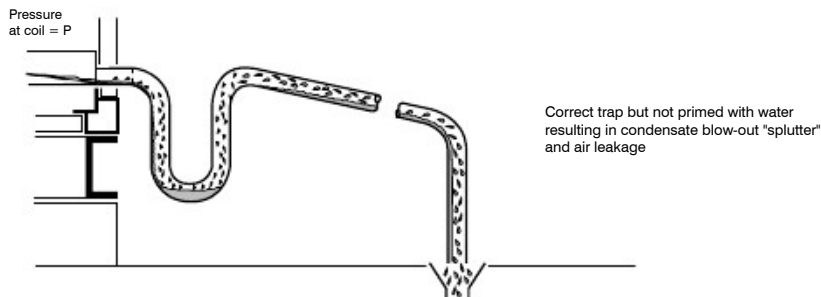
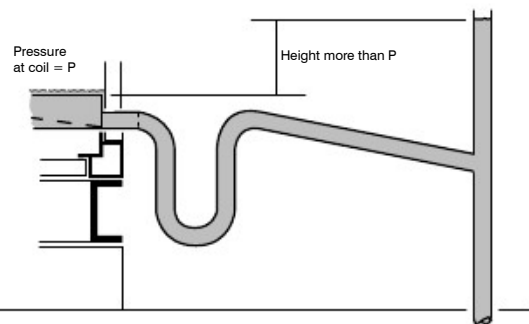


## 5.5 Commissioning Coils - Condensate Drain Faults

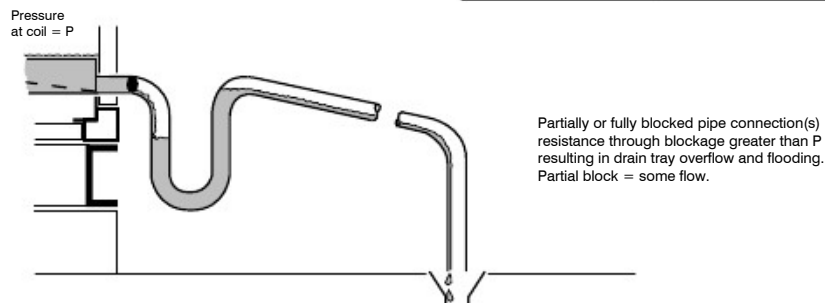
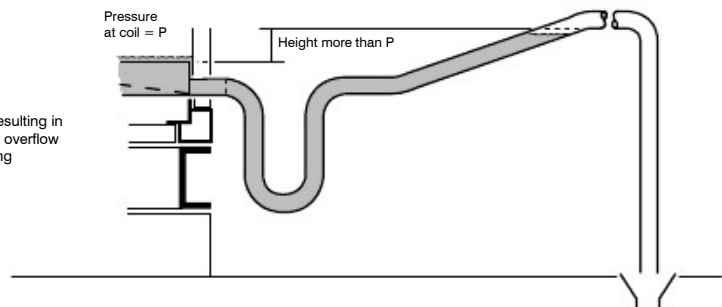
Blow through



Not draining into an open tundish but connecting to a full pipe resulting in condensate drain tray overflow and flooding

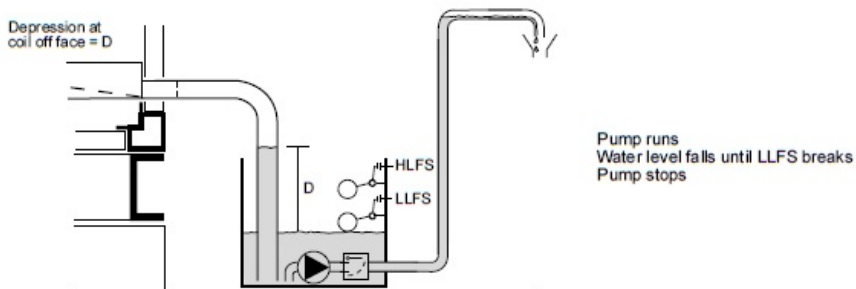
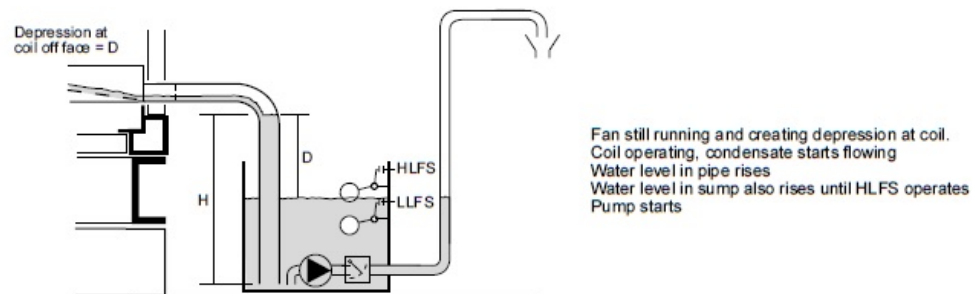
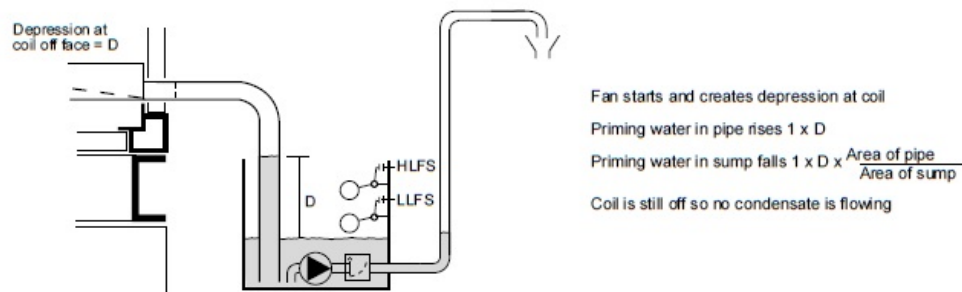
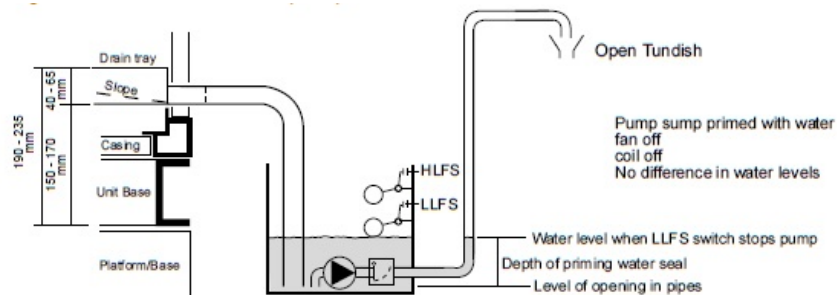


Reverse pipe slope resulting in condensate drain tray overflow and flooding



## 5.5 Commissioning coils

Draw through coils with condensate pump



H = depression at off face of cooling coil + difference in level between HLFS operating and pipe openings

10 pa difference in pressure = 1mm difference in water level i.e. 190mm = 1900 pa depression - 235mm = 2350 pa depression

## 5. Commissioning

### 5.6 Commissioning DX Cooling Coils

Coils are normally of open header box construction (but may have split end covers supplied to order) are completely self supporting and designed to be fitted directly between or within the sections of the air handling unit.

When split cover plates are supplied these should be removed prior to connections being made, then replaced. Great care should be taken when tightening connections to avoid damage to the coil. The space between the the pipework and cover plates should be sealed with a grommet or similar.

A correctly sized thermostatic expansion valve with external equalising connection must be fitted.

Run the liquid refrigerant line to the TEV which should be fitted to the liquid distributor, feeding the individual circuits of the evaporator coil.

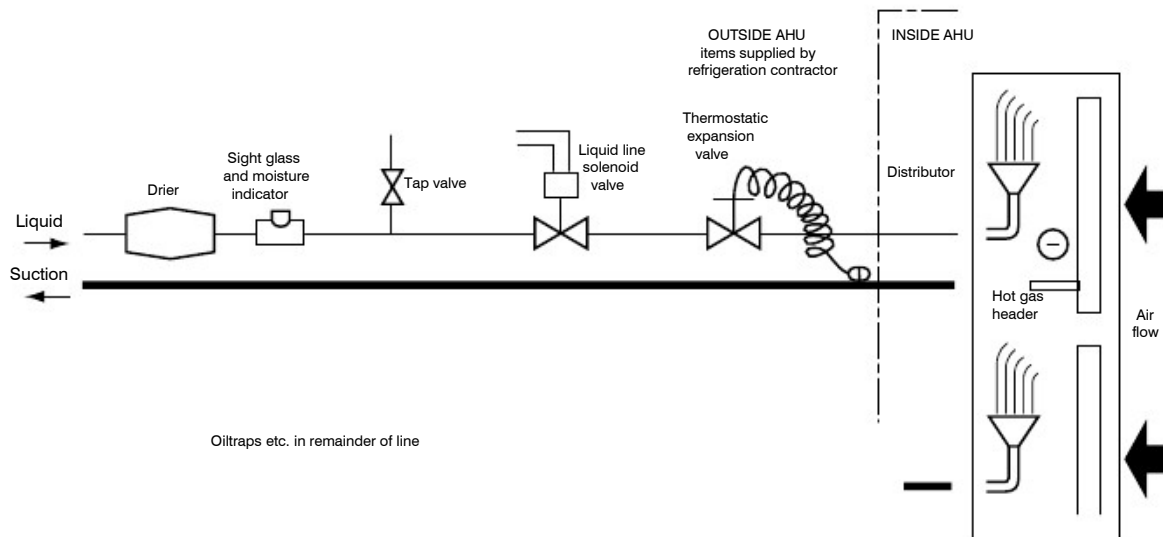
An adequately sized suction line should be run from the suction header to the compressor.

The valve equalising line should be run to the suction line on the compressor side of the valve sensitive phial which should be placed on top of the suction line periphery and secured with a special clip.

A suction-liquid heat exchanger should be used to improve the performance of the expansion valve and utilise the complete coil surface.

A correctly sized sloping drain line with a cleanable 'U' bend water trap terminating at an open drain or tundish should be run from each drain connection.

A TYPICAL ARRANGEMENT FOR DIRECT EXPANSION COOLING COIL  
(R22 PIPEWORK ONLY)



## 5. Commissioning

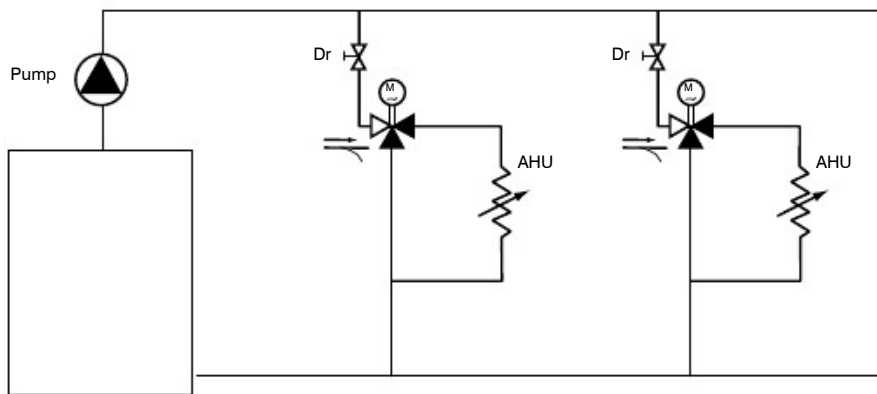
### 5.7 Commissioning Chilled Water Cooling and LP Hot Water Heating Coils

Guidelines for water circuits in C.W. Coolers and LPHW Heaters

#### Bypass Circuit

Tightly closing three-way valves are required as the regulating valves. At nominal flow the pressure drop across the valves (pv100), should range from approximately the same value to about double the value of the pressure drop across the heating load branch at nominal flow.

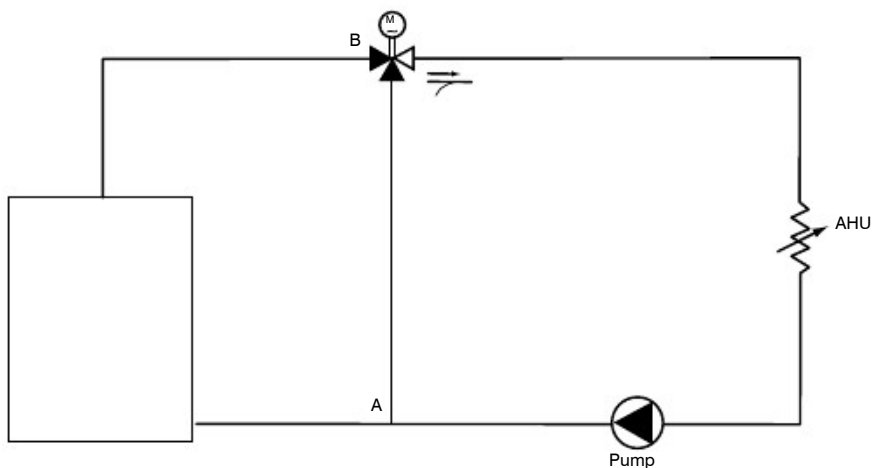
The balancing valves are used to adjust the water volumes for the individual heating circuits.



#### Mixing circuit using three-way mixing valves

Slipper valves can generally be used. The nominal size is usually chosen equal to the nominal size of the pipe. However, from the point of view of hydraulics, slipper valves one size smaller than the nominal size of the pipe are preferable.

In systems where the pressure difference between A and B exceeds approximately 0.8 mWG, it must be checked that the leakage losses of the slipper valves remain within tolerable limits. If this is not the case, seat valves are to be used.



## 5. Commissioning

### 5.7 Commissioning Chilled Water Cooling Coils

Coils are normally of open header box construction (but may have split end covers supplied to order) are completely self supporting and designed to be fitted directly between or within the sections of the air handling unit.

When split cover plates are supplied these should be removed prior to connections being made, then replaced. Great care should be taken when tightening connections to avoid damage to the coil. The space between the the pipework and cover plates should be sealed with a grommet or similar.

A correctly sized thermostatic expansion valve with external equalising connection must be fitted.

Run the liquid refrigerant line to the TEV which should be fitted to the liquid distributor, feeding the individual circuits of the evaporator coil.

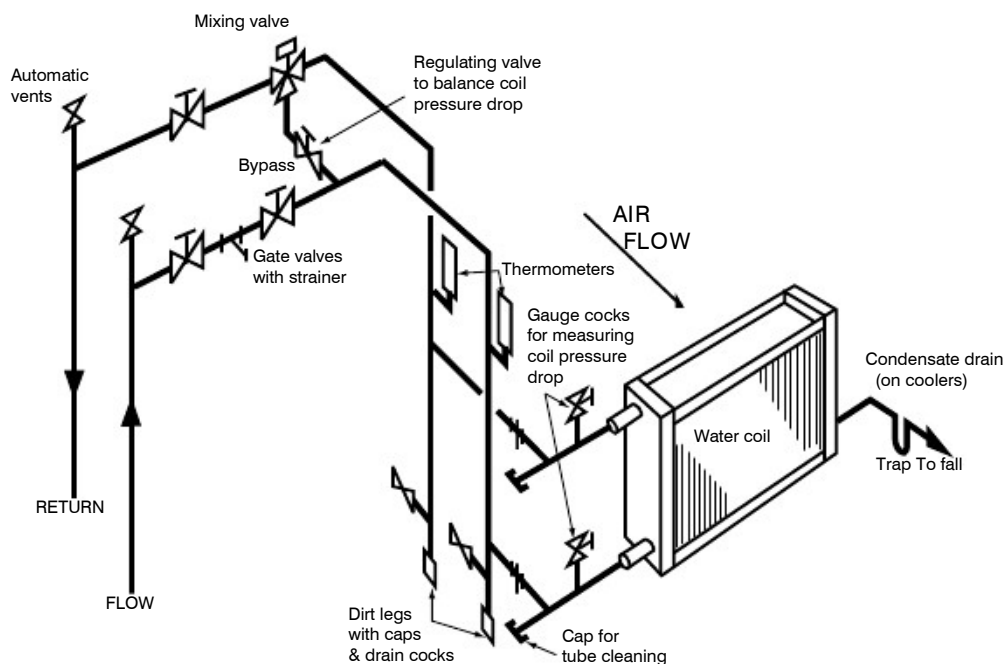
An adequately sized suction line should be run from the suction header to the compressor.

The valve equalising line should be run to the suction line on the compressor side of the valve sensitive phial which should be placed on top of the suction line periphery and secured with a special clip.

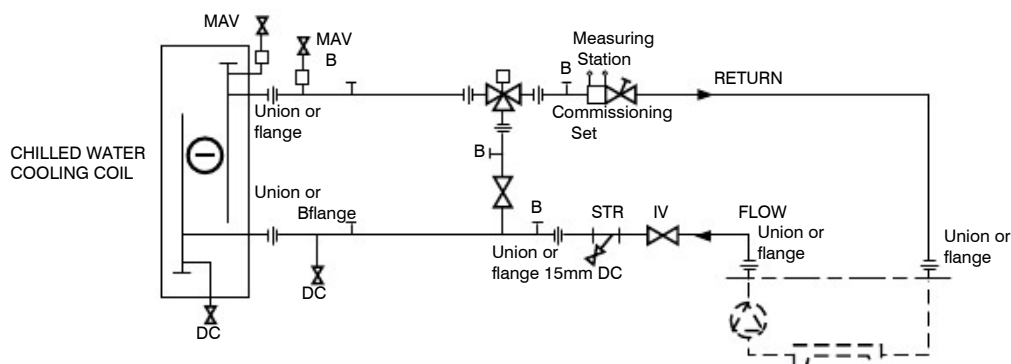
A suction-liquid heat exchanger should be used to improve the performance of the expansion valve and utilise the complete coil surface.

A correctly sized sloping drain line with a cleanable 'U' bend water trap terminating at an open drain or tundish should be run from each drain connection.

#### A TYPICAL PIPING ARRANGEMENT FOR CHILLED WATER COIL PIPED IN COUNTER-FLOW



#### A TYPICAL SCHEMATIC FOR CHILLED WATER COOLING COIL



## 5. Commissioning

### 5.8 Commissioning Hot Water Heating Coils

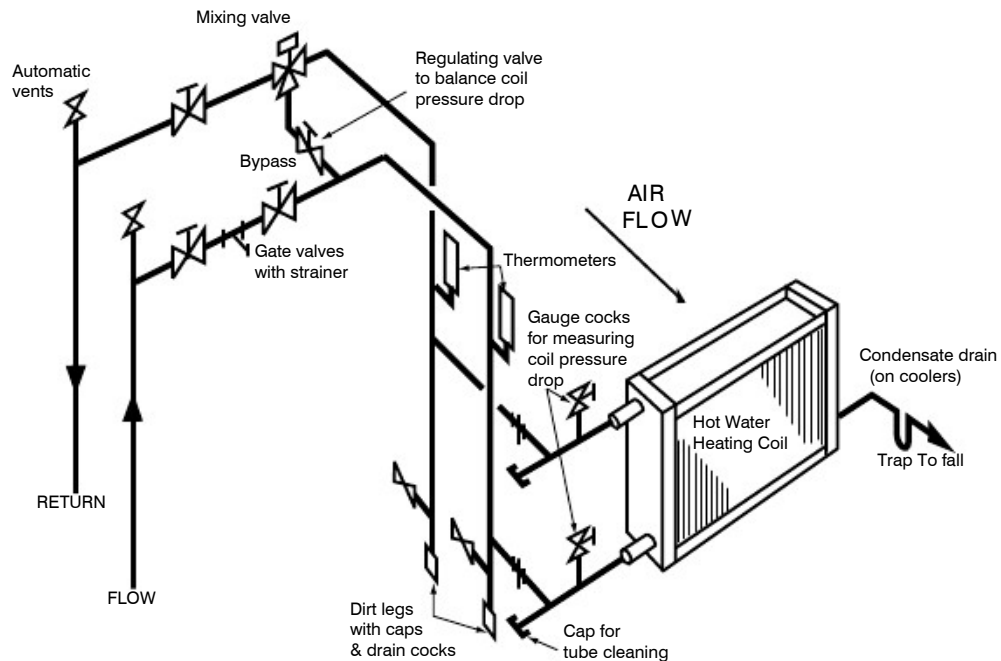
Coils are normally of open header box construction (but may have split end covers supplied to order) are completely self-supporting and designed to be fitted directly between or within the sections of the air handling unit.

When split cover plates are supplied these should be removed prior to connections being made, then replaced. Great care should be taken when tightening connections to avoid damage to the coil. The space between the pipework and cover plates should be sealed with a grommet or similar.

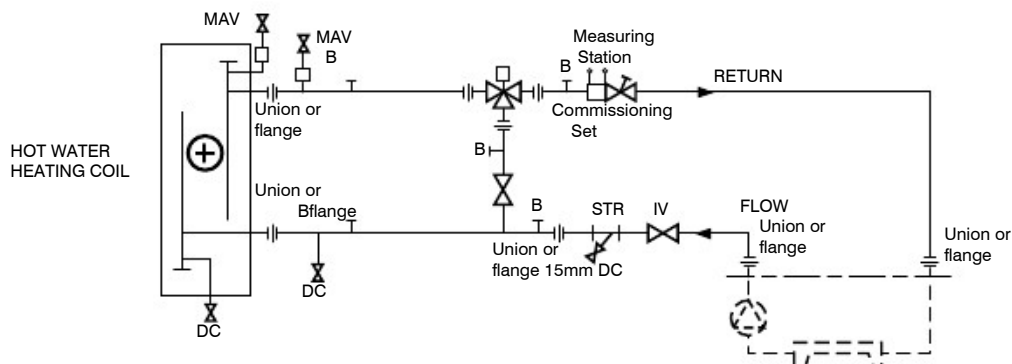
A correctly sized sloping drain line with a cleanable 'U' bend water trap terminating at an open drain or tundish should be run from each drain connection.

Heater coil automatic control valves should be wired into the fan starter circuit so that valve motors close when fan is stopped. This prevents temperature build up within the unit and possible harm to motor windings, particularly important with high pressure hot water or steam coils.

A TYPICAL PIPING ARRANGEMENT FOR HOT WATER HEATING COIL



A TYPICAL SCHEMATIC FOR HOT WATER HEATING COIL



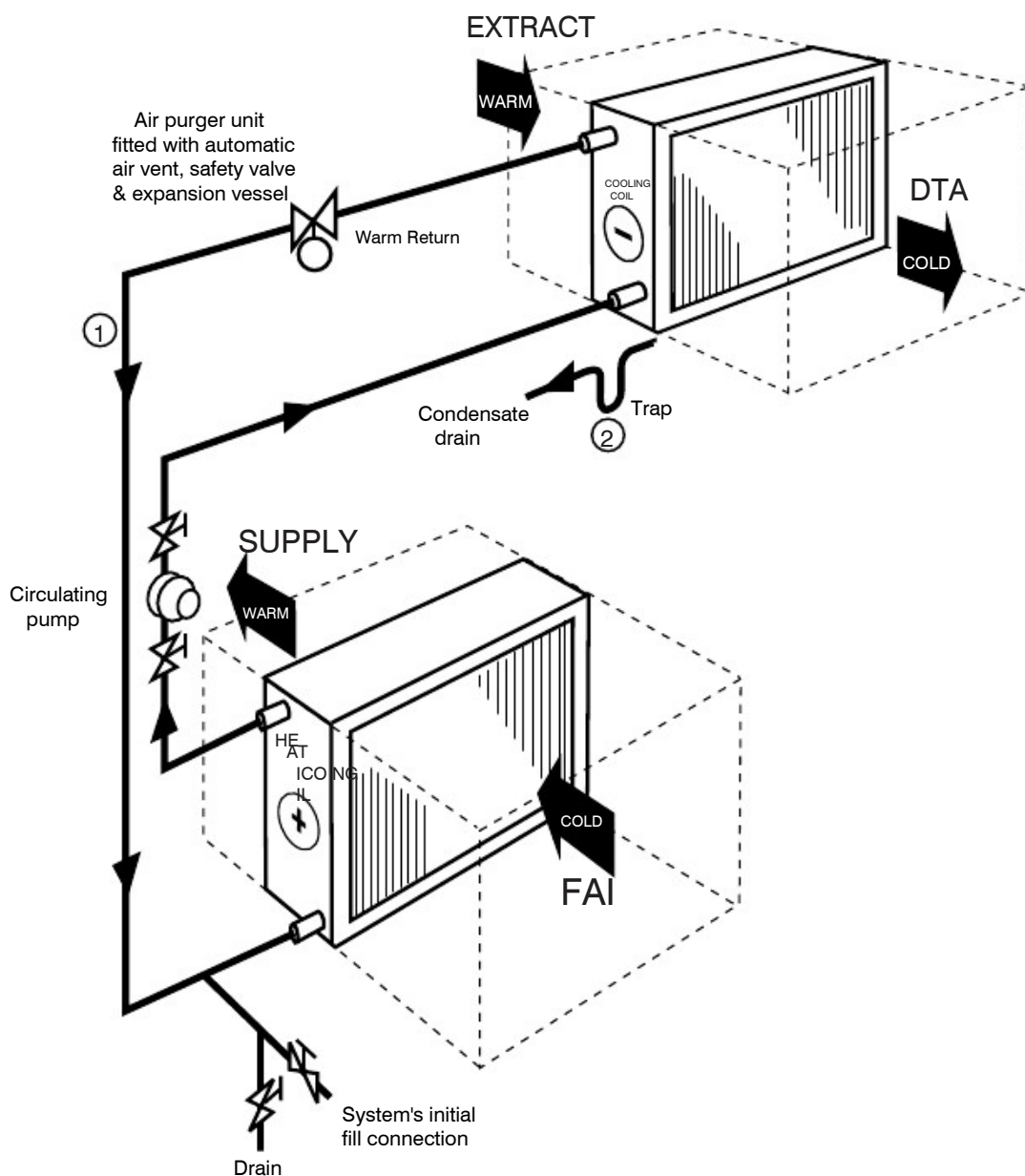
## 5. Commissioning

### 5.8.1 Commissioning Runaround Coils

#### A TYPICAL PIPING ARRANGEMENT FOR RUNAROUND COILS AIR HANDLING UNITS SEPARATED

Heat transfer medium water/glycol (minimum 15%, maximum 25%)

Runaround systems are used for heat recovery only, coolth recovery is not a economically viable proposition.



#### NOTES:

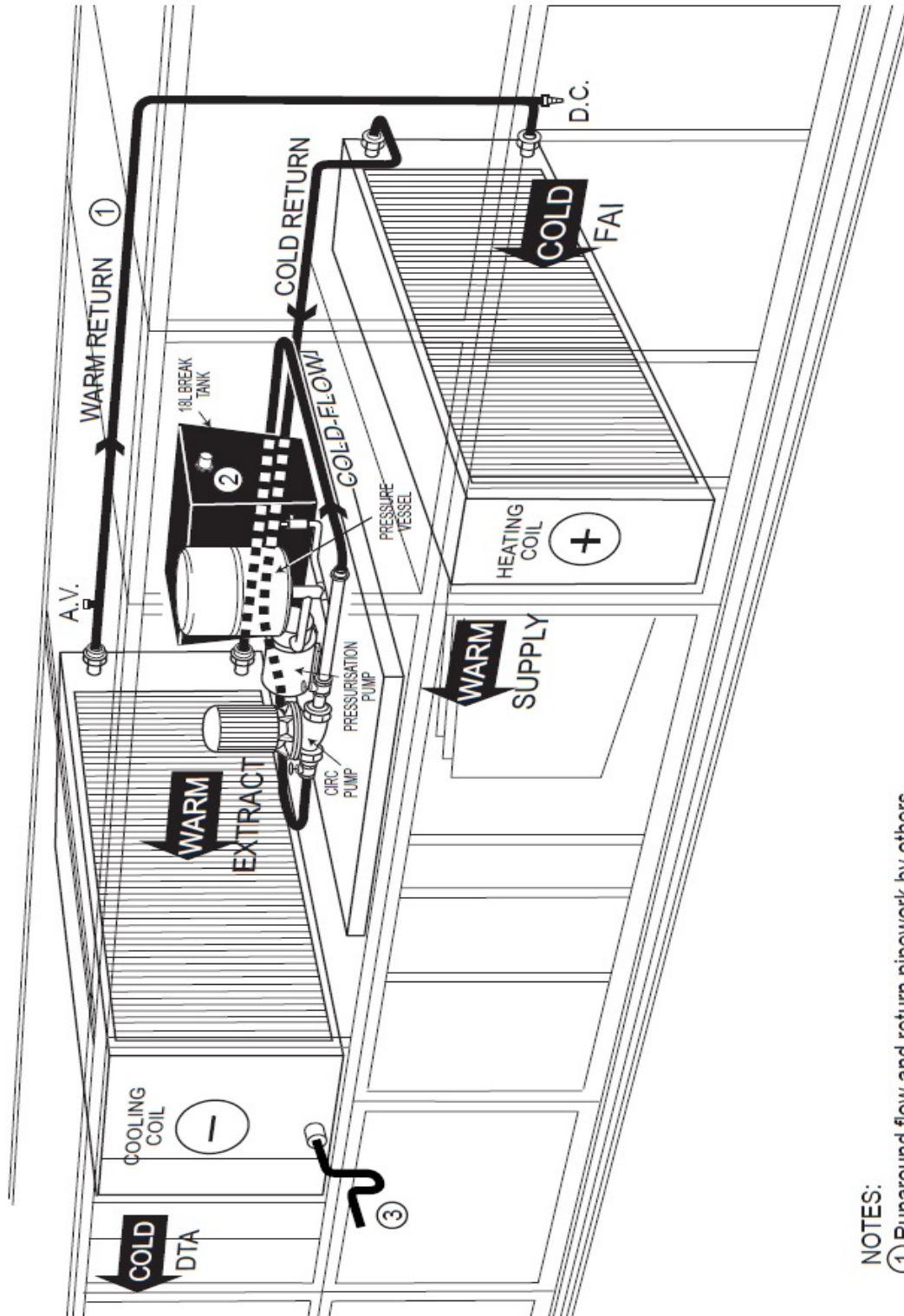
- ① Runaround flow and return pipework by others.
- ② Differential condensate trap by others.

## 5. Commissioning

### 5.8.2 Commissioning Runaround Coils

#### AIR HANDLING UNIT INTEGRAL RUNAROUND SET

- (1) Heat transfer medium water/glycol (minimum 15%, maximum 25%)  
(2) Runaround systems are used for heat recovery only, coolth recovery is not an economically viable proposition.



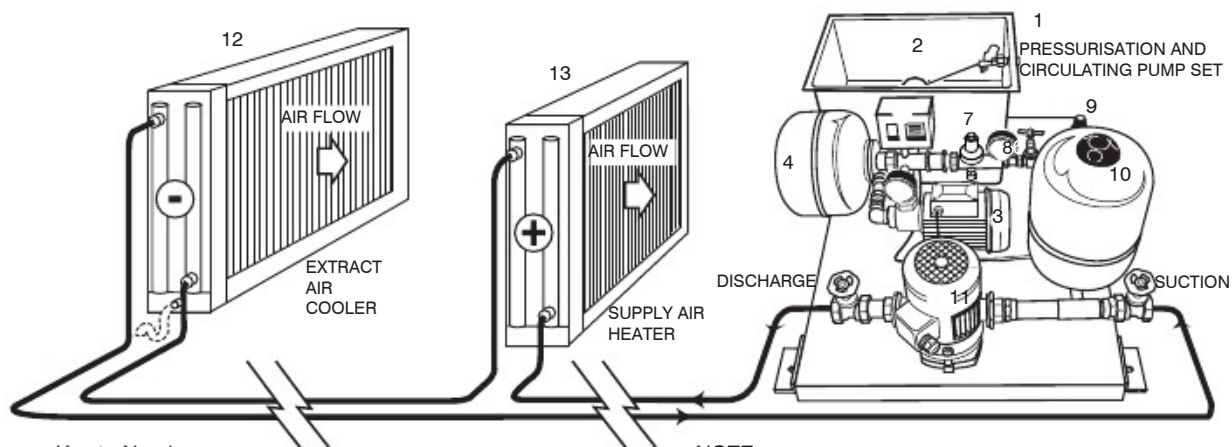
#### NOTES:

- ① Runaround flow and return pipework by others.
- ② 15mm connection to ball valve. Pipework from rising main by others.
- ③ Differential condensate trap by others.

## 5. Commissioning

### 5.8. Commissioning Runaround Coils -

#### 5.8.3. Single Pressurisation Pump, Single Circulating Pump



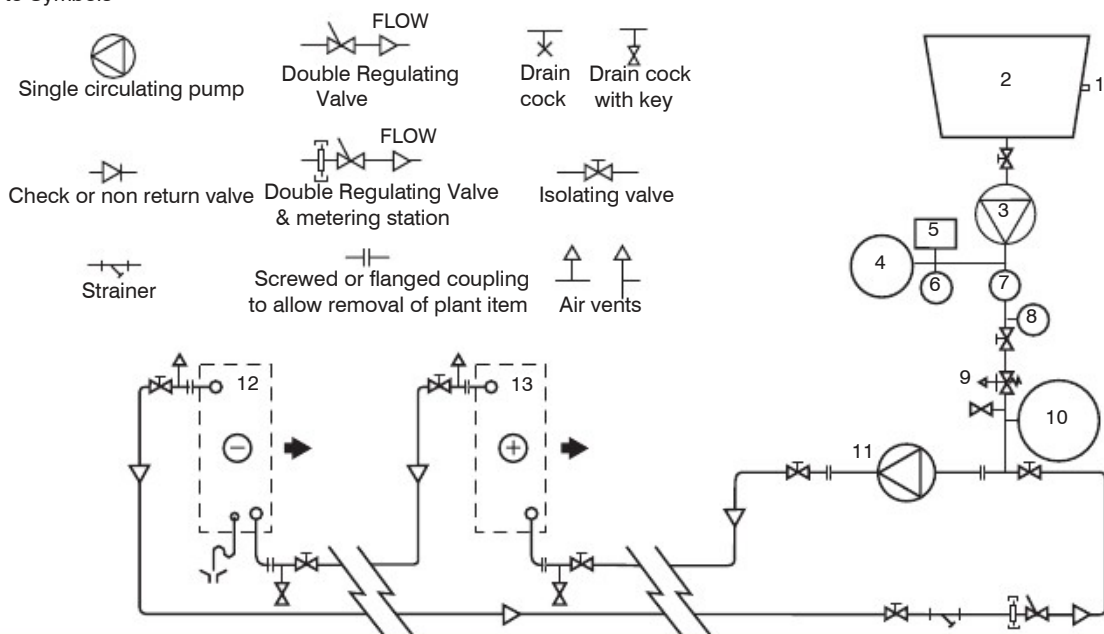
#### Key to Numbers

1. Mains in - if fitted and not hand fill & top up during maintenance
2. Break tank with ball valve, type A air gap and lid
3. Pressurisation pump
4. Expansion vessel controlling pressurisation pump
5. Pressurisation pump, pressure control switch
6. Dial gauge 0 - 100 psi, 0 - 7 bar
7. Pressure regulator
8. Dial gauge 0 - 4 bar red line at 3 bar
9. 6 Bar safety valve (partly hidden)
10. Pressurized system expansion vessel
11. Circulation pump
12. Extract air runaround heat recovery cooling coil with eliminators, drain pan & condensate drain connection drain trap & drain fitted on site
13. Supply air run around heat recovery heating coil

#### NOTE.

Heat gains to water from pump and pipework plus heat gains to air from fans, ducting and air handling plant, low extract air to outside air temperature differences combined with recovery efficiencies of circa 50% mean that run around energy recovery systems are usually only used for recovering heat in winter.

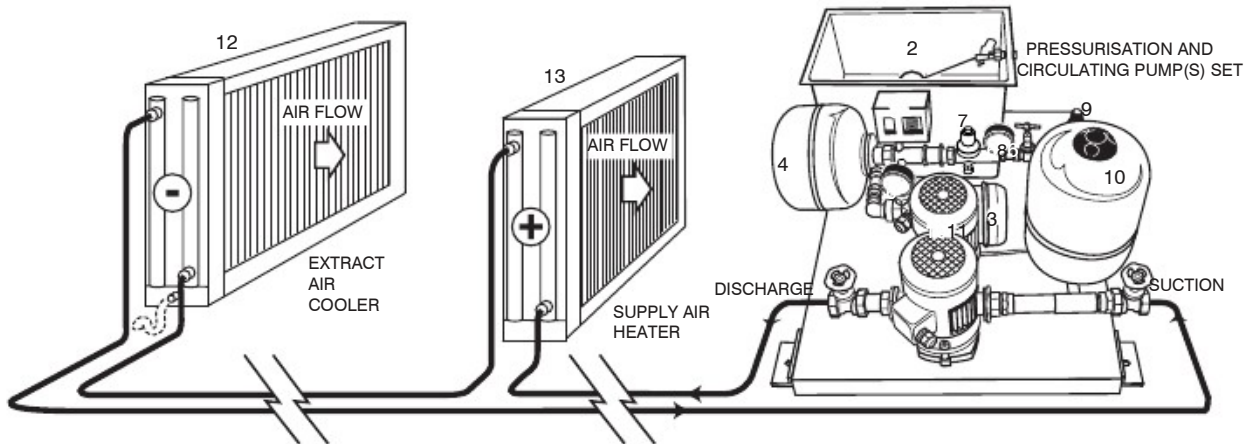
#### Key to Symbols



## 5. Commissioning

### 5.8 Commissioning Runaround Coils -

#### 5.8.4. Single Pressurisation Pump, Twin Circulating Pumps with Flow Switch and Auto Changeover



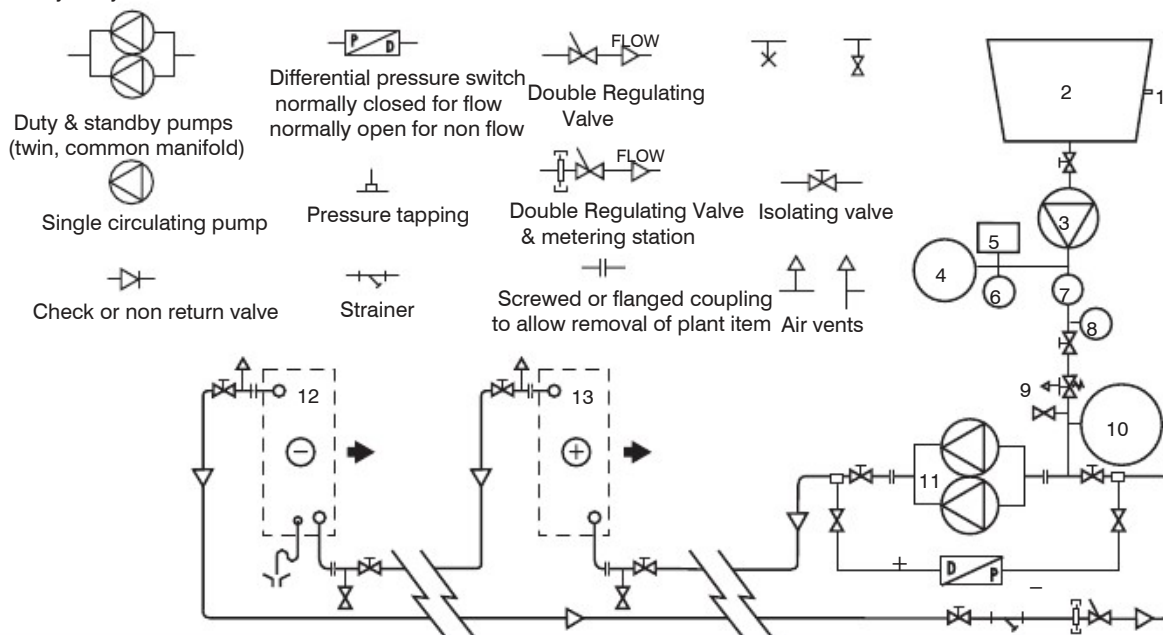
#### Key to Numbers

1. Mains in - if fitted and not hand fill & top up during maintenance
2. Break tank with ball valve, type A air gap and lid
3. Pressurisation pump
4. Expansion vessel controlling pressurisation pump
5. Pressurisation pump, pressure control switch
6. Dial gauge 0 - 100 psi, 0 - 7 bar
7. Pressure regulator
8. Dial gauge 0 - 4 bar red line at 3 bar
9. 6 Bar safety valve (partly hidden)
10. Pressurized system expansion vessel
11. Duty and standby (twin, common manifold) pumps
12. Extract air runaround heat recovery cooling coil with eliminators, drain pan & condensate drain connection drain trap & drain fitted on site
13. Supply air run around heat recovery heating coil

#### NOTE.

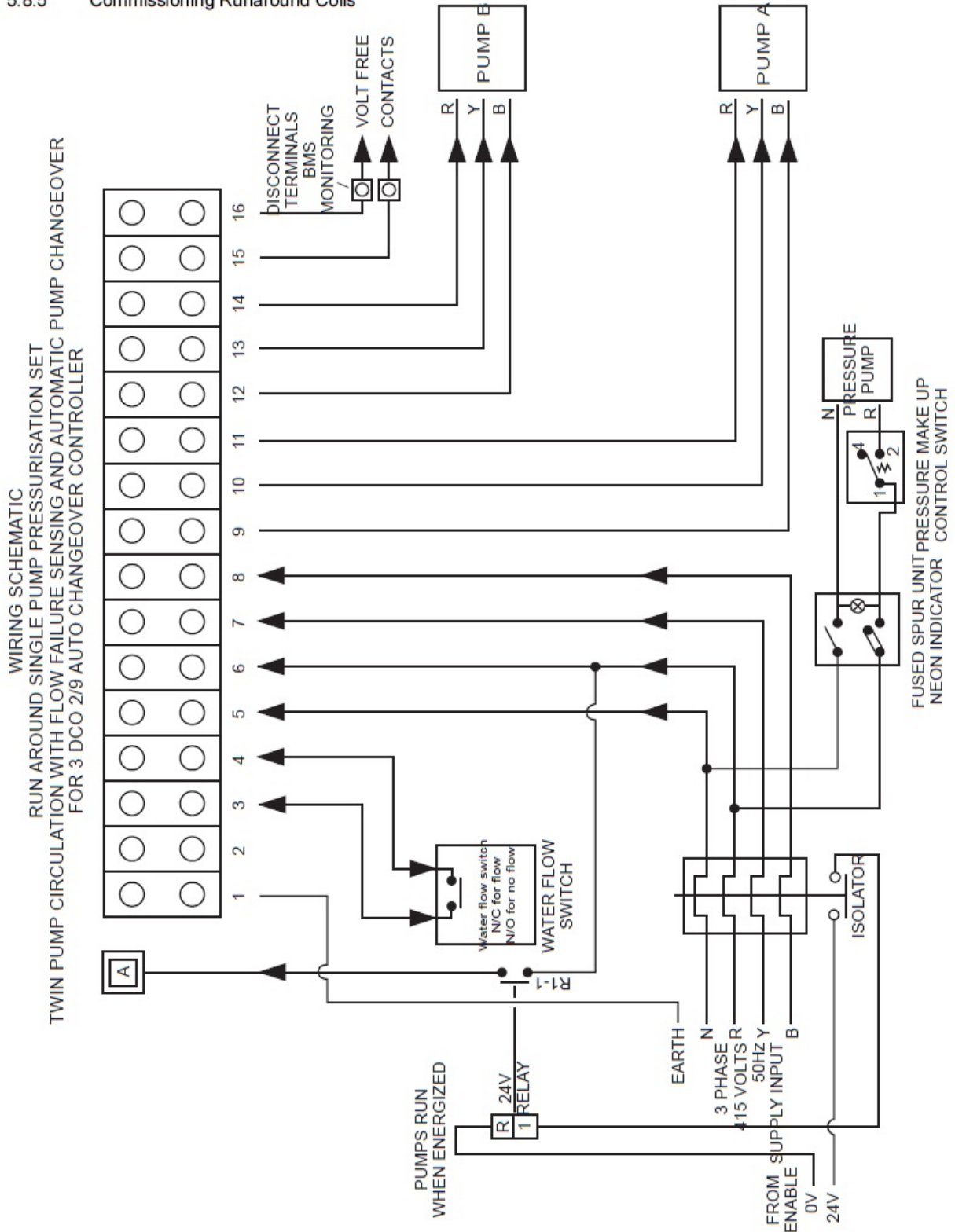
Heat gains to water from pump and pipework plus heat gains to air from fans, ducting and air handling plant, low extract air to outside air temperature differences combined with recovery efficiencies of circa 50% mean that run around energy recovery systems are usually only used for recovering heat in winter.

#### Key to Symbols



## 5. Commissioning

### 5.8.5 Commissioning Runaround Coils



## 5. Commissioning

### 5.10 Commissioning Steam Coils

Coils are normally of open header box construction (but may have split end covers supplied to order) are self supporting and designed to be fitted directly between or within the sections of the air handling unit.

When split cover plates are supplied these should be removed prior to connections being made, then replaced. The space between the the pipework and cover plates should be sealed with a grommet or similar.

Check:

Supply is under 100 PSIG dry.

Supply is free of air and connected to the top coil connection.

Connecting pipe work is not supported by coil.

Expansion allowance made for coil tubes.

Connections are free from stress and are properly pitched and drained (to avoid water hammer).

Condensate connections to the steam trap are the same size as the coil outlet.

Condensate in the main is independently trapped on a coil bypass.

The steam trap is sized on 3 times the design flow.

Float or bucket type traps should be carefully selected to suit the steam pressures and temperatures with thermostatic

air relief traps on low pressure systems and continuous venting petcocks on medium and high pressure systems.

Multiple or banks of coils must be individually trapped to meet the demands of the varying capacities and pressures on each section.

Selection of control valves must be based on the steam load and not the size of the steam coil supply connection.

Automatic steam control valves are suitable where the condensate is returned to atmospheric pressure or under vacuum.

They are not recommended on systems where pressure is maintained on the return lines.

Steam pressure in the coil is not used for lifting condensate.

If coil is near filter ensure fan runs on after steam supply is cut off (2 minutes).

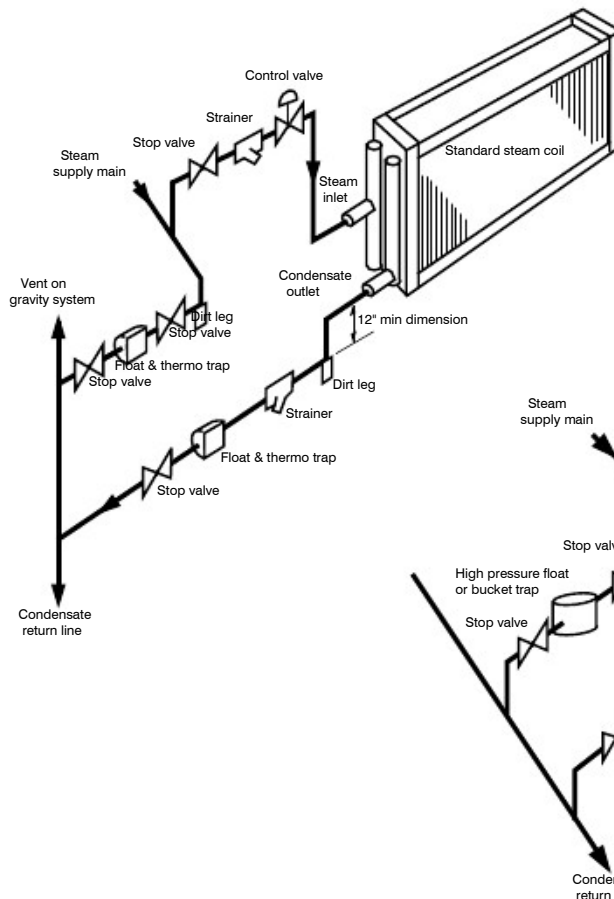
Note:

Over tightening connections damages coils.

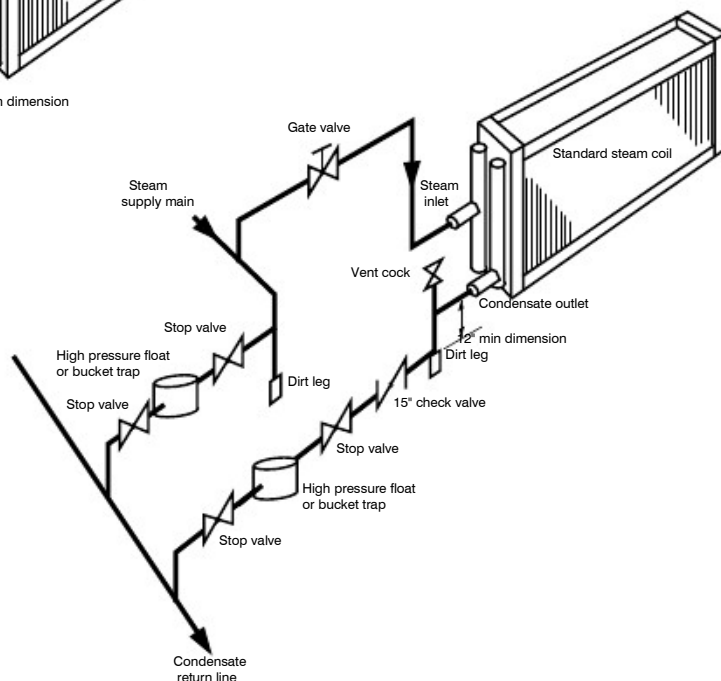
Initial rapid heat build up causes damage to coils and associated pipe work, valve opening must be gradual.

Check for leaks on initial start up and after a short period of operation.

A TYPICAL PIPING ARRANGEMENT FOR  
LOW PRESSURE STEAM OR VACUUM SYSTEM



A TYPICAL PIPING ARRANGEMENT FOR  
HIGH PRESSURE STEAM SYSTEM



## 5. Commissioning

### 5.11 Commissioning Electric Heater Batteries

IF NOT PROPERLY INSTALLED AND CONTROLLED EAHB'S ARE DANGEROUS. THEY CAN CAUSE SERIOUS INJURY OR DEATH AND START FIRES. ASK YOUR LOCAL ELECTRICITY BOARD FIRE OFFICER AND ENGINEERS DEPARTMENT TO INSPECT YOUR INSTALLATION BEFORE USE.

Access is by the access door clamped on the side of the unit. Cable entry should be made by drilling a suitable hole in the folded angle corner posts. Screwed glands with cable holding devices should be used at all drilled holes. Do not use P.V.C. cable inside the unit.

Generally elements are intended for phase to neutral connection balanced across a 415/3/50 supply e.g. 3 elements phase to neutral per stage. Before connecting out of balance loads consult with your local electricity board.

All wiring must be to I.E.E. regulations and conform to all local and national statutory requirements.

A high temperature S.P.D.T. cut out which opens at 165°C is fitted, and must be wired in line with the coil of the main EAHB contact breaker. Should this cut out operate, the cause must be ascertained before the hand reset is pushed back in, since the elements may rise to 600°C in still air causing filter damage, motor burn out and fire damper link failure etc. etc.

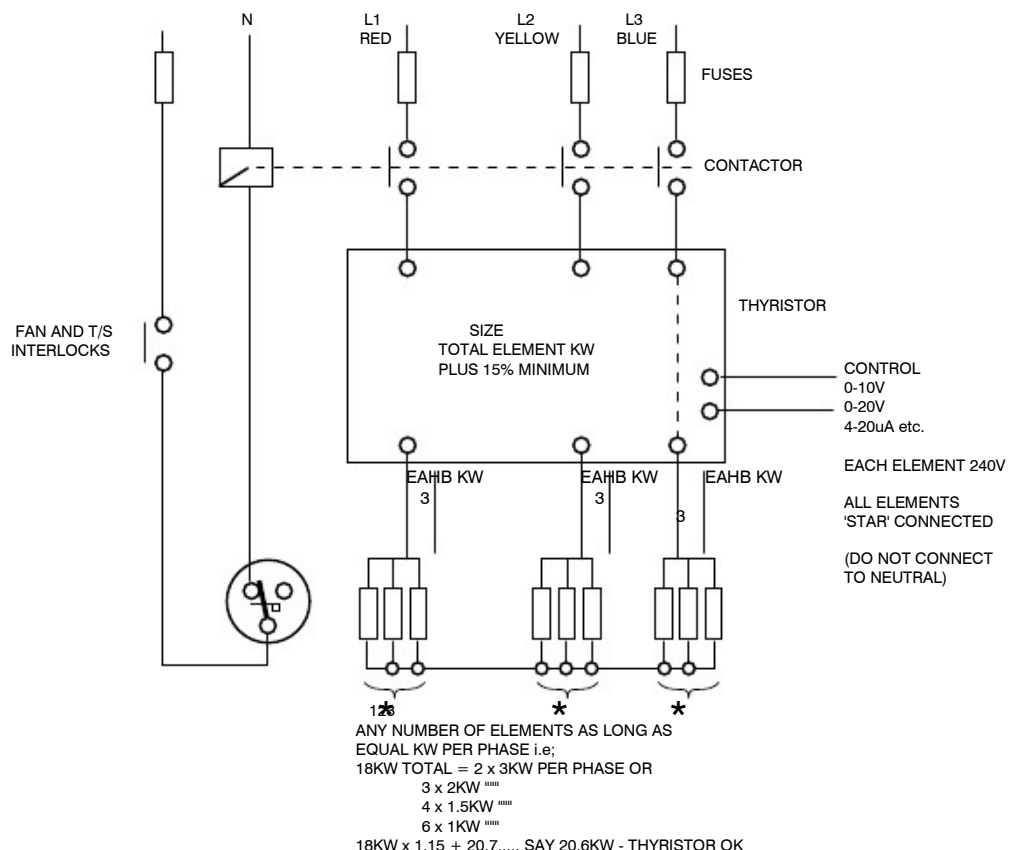
An airflow switch rated at the correct minimum velocity must be fitted (a filter pressure differential switch is NOT suitable).

Fan interlock with the EAHB and fan overrun (of up to 10 minutes after heater battery off depending on EAHB bank size) must be fitted together with automatic recycle to zero load on step controller.

Always ISOLATE the supply before removal of access door and REPLACE the access door before reconnection of supply.

THE ELEMENT TRAY MUST BE EARTHED

TYPICAL SCHEMATIC FOR ELECTRIC HEATER BATTERY



## 5. Commissioning

### 5.12 Commissioning Gas Fired Heaters

#### Safety Notes:-

Commissioning is recommended by our operatives, in any event gas piping, flue, electricity supply and controls should comply with gas safety, gas region, local authority, fire authority and insurance company regulations. Do not locate in presence of chlorinated or corrosive vapours, in areas of high risk i.e. cellulose spraying, near combustible materials or where atmospheric depression i.e. an area with extract fan or system, could cause gas reverse flow into area.

Ensure 24" minimum clearance all round this section.

Do not obstruct or modify built in diverter.

Except for servicing never switch of the power supply to the unit.

#### Internal Safety controls comprise:-

Main gas valve closure if pilot light out

Fan on delay until burner warm.

Gas off on overheat

Fan off delay until burner cool

#### External services required:-

Natural gas supply

Combustion air supply

Combustion gas flue

Electricity supply for controls

Electricity supply for motive power

#### Flue gas discharge

Flue gas leaving the top spigot at 260°C should be vented to atmosphere using a gas board approved flue terminal via a properly sized, individual, VERTICAL, natural draught flue rising 1.8m min.

Unavoidable horizontal runs (max 3m) should slope 65mm in 300mm and have final verticals riser of 1.5 times the horizontal run. If these conditions cannot be met then factory installed fan assistance should be considered.

If condensation is possible it should be avoided by using double skinned flue with special joiner and spigot (consult your local G.A.). If condensation still occurs a non-corrosive 22mm (min) drain should be fitted.

#### External controls required are:-

On/off switching (time clock start/stop, thermostat controlling burner)

Normal electrical controls (fan motor starter, contactors and overload isolators etc.)

#### Wiring

Refer to appropriate diagram supplied with unit and note the following:-

Switching must be by individual 24V controls to each unit and should incorporate a 24V thermostat, switch and time clock in series.

Never apply higher voltages (240V supply to motor of time clock must be separate).

Power into the control box can only be 220V 1 phase 50c/s.

Single phase fan motors up to 0.5KW (0.7h.p.) can be connected via thermal overloads direct to the box.

Over 0.5kW single phase and all 3 phase motors must have separate electrical supplies controlled from the box via a 240V contactor relay and should be protected by thermal overloads.

#### Inspection prior to initial startup

Gas shut off valve closed:-

Check all electrical functions - fan motors, room thermostat and gas control set/automatic gas safety system.

Check correct rotation of fans.

#### Gas shut off valve open:-

carefully vent and check all gas lines for leakage by soapy water testing.

Close gas shut off valve.

#### Initial startup

Switch on main switch

Supply air discharge(s) open

Room thermostat 'off' lowest setting

Time switch at 'on' period

Turn on main gas

The unit will now start

Refer to user manual supplied with gas heater unit for detailed startup procedure.

## 5. Commissioning

### 5.13 Commissioning Electronic Steam Humidifiers

#### General

Humidifiers supplied for use with ECE units are electrode boilers which operate at atmospheric pressure and utilise standard water supplies provided the local regulations regarding connection of this type of equipment are observed. Should local regulations call for the use of a break tank to feed the unit, the speed at which the humidifier cylinder fills will be determined by the head pressure available. The size of tank, its height and the size of its connecting pipework must be chosen carefully to ensure the unit always receives an adequate water supply.

A built in flow regulator compensates for pressure fluctuations.

#### Water - drain connections

Standard unit inlets are supplied with 15mm brass compression fittings.

Drains are brass couplings of 1.5" BSP male thread and 1.25" BSP female thread sizes.

#### Power supply

Connect using conduit entry glands through appropriate knockouts in casing.

Wiring should comply with the relevant local regulations using appropriately sized circuit breakers.

#### Control connection

When step control or modulation is required, the boiler, services and controls are mounted in a cabinet which may be fixed to the side of the air conditioning unit or to an adjacent vertical surface **BELOW** the sparge pipe level.

When on-off switching only is required the boiler and its services may be mounted inside the air conditioning unit with the control panel remote.

#### Start up

Close electrical panel

Turn on water supply to humidifier

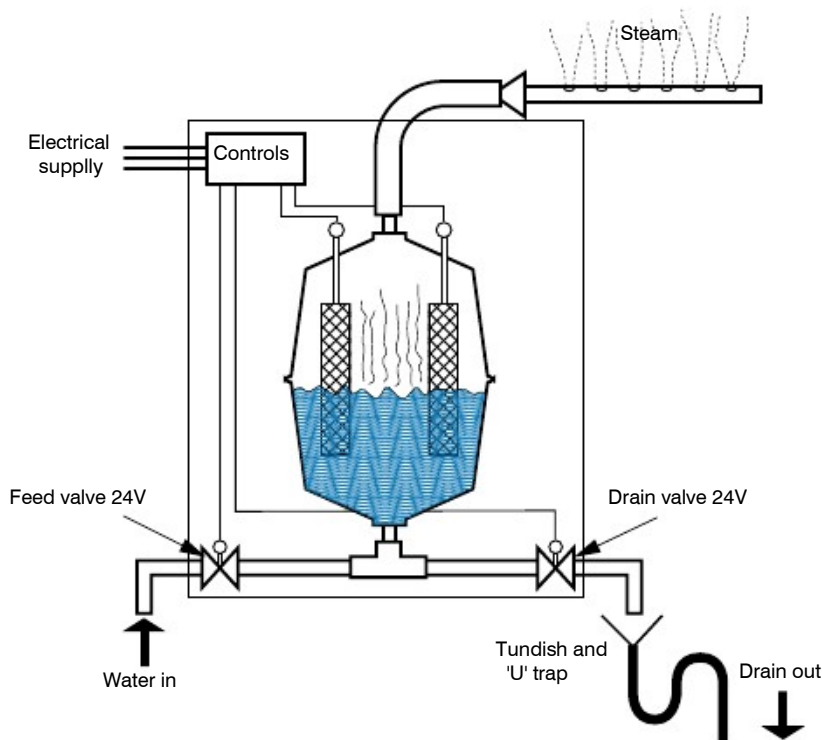
Close circuit breaker feeding power supply to humidifier

Put run/drain switch into the 'RUN' position

Put on/off switch into the 'ON' position

Humidifier will now operate to the demands of the control circuit.

### OPERATION OF TYPICAL ELECTRONIC STEAM HUMIDIFIER



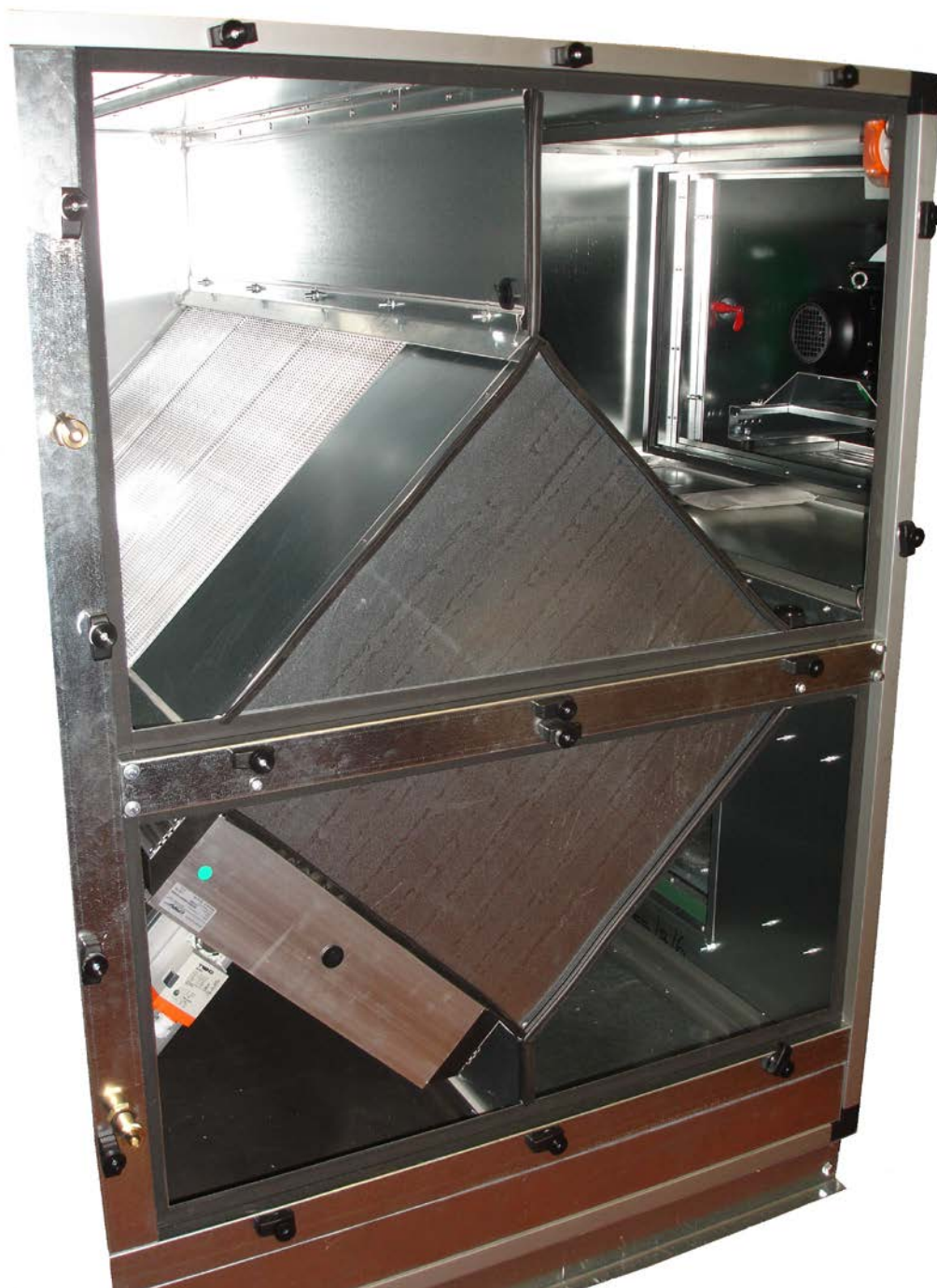
## 5. Commissioning

### 5.14 Commissioning Plate Heat Exchanger

Before commissioning, ensure that the air streams can flow freely through the plate heat exchanger.

If dampers are fitted, check their movement and correct adjustment.

Furthermore check if installation has been carried out correctly and make sure the application limits (temperature, pressure difference, material etc.) cannot be exceeded



## 6. Maintenance

### 6.1 Maintenance Schedule\*

Item	Further detailed instructions see section indicated	Interval			
		1 mth	2 mths	3 mths	4 mths
Fan impeller cleaning					•
Fan motor - cooling vents clear, bearings check				•	
Fan vee-belt drive, wear, tension, alignment			•		
Filter panels check, clean or renew as necessary		•			
Filter bag check, clean or renew as necessary:- Standard				•	
Fine			•		
Extra fine			•		
Filter absolute and activated carbon check, clean or renew as necessary		•			
Filter autoroll check, clean or renew as necessary		•			
Filter condition indicator & autoroll controls - operation					•
Coils venting			•		
Coils surfaces, connecting piping				•	
EAHB's continuity, earthing, HT cut out				•	
Wiring, flow switch, fan overrun, controls				•	
Dampers, bearings, links, free movement				•	
Dampers, motors, bearings, free movement				•	
Gas fired heater, all points				•	
Humidifier cylinder electrodes		•			
Humidifier controls, wiring, piping				•	
Metal, paint, sealing strips, sealant, fixings					•
Insulation, A/V's, flex. connections, fixings				•	
Wiring, controls, earth continuity				•	

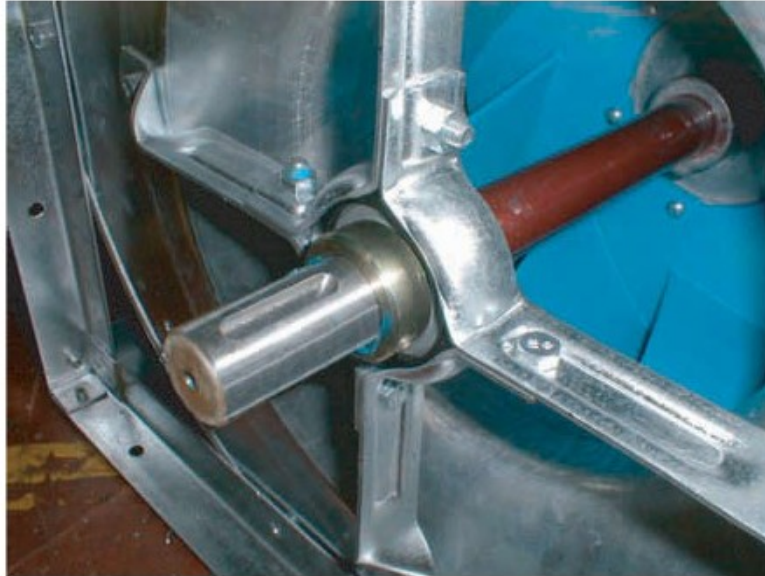
\*This Schedule is not intended to be exclusive, inclusive or mandatory. Different conditions of use may dictate shorter or longer periods and or more intensive action.

## 6 Maintenance

### 6.2 Maintenance Action (not already indicated in Schedule) FAN BEARINGS

Spider arm bearing -  
Sealed ball races mounted in rubber, pre-greased and self align

ing for service free use under normal duties.



#### UNITS IN THE ECE RANGE FITTED WITH SPIDER ARM BEARINGS

TL3  
up to 400



TL3  
450 - 630



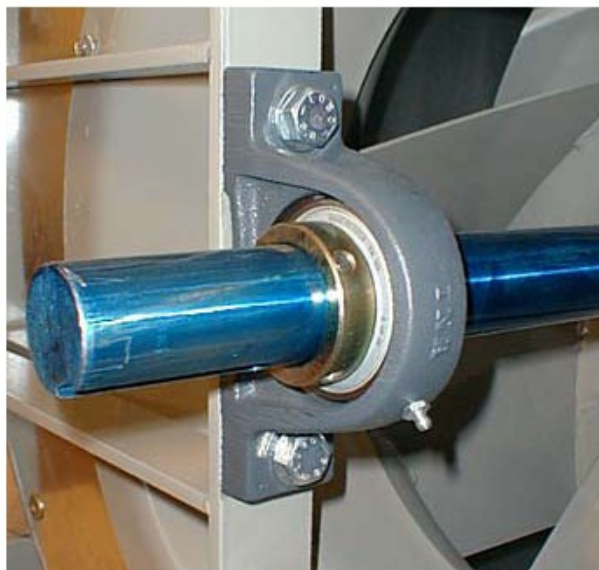
THLZ Duplex -  
3 No. spider arm  
bearings

## 6. Maintenance

### 6.2 Maintenance Action (not already indicated in Schedule) FAN BEARINGS

Plummer Block bearing -

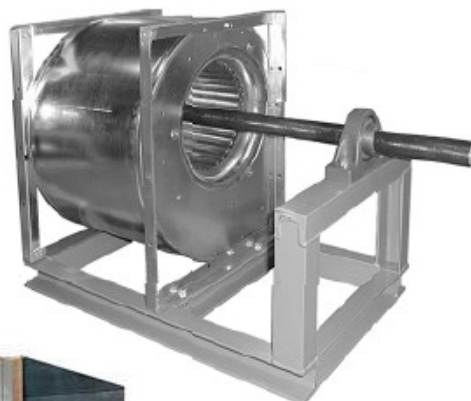
Sealed ball races, self-aligning and mounted in cast iron supports, pre-greased with grease points.



#### UNITS IN THE ECE RANGE FITTED WITH PILLOW BLOCK BEARINGS



Extended shaft  
'A' Frame



NTH3 T2  
710 -1000

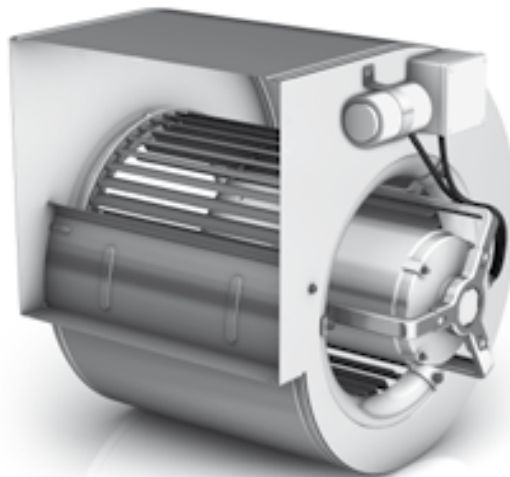
## 6. Maintenance

### 6.2 Maintenance Action (not already indicated in Schedule) FAN BEARINGS

#### Direct Drive Fans -

The impeller is keyed to the motor which is mounted on a support attached to the fan casing.

Motor bearings are sealed ball races mounted in rubber, pre-greased and self-aligning for service free use under normal duties.



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## 6. Maintenance

### 6.2 Maintenance Action (not already indicated in Schedule)

#### MOTOR BEARINGS

Self-aligning self-oiling and spring loaded ball lubricators, use light machine oil.

Pressure grease fittings and relief plugs, wipe down fitting, remove pressure plug (if fitted) and hardened grease. Add grease till NEW grease is expelled, run motor for 10 minutes, stop motor, clean and replace plug.

The bearing should be repacked with Shell Alvania 2, BP Energ grease 2 or Esso Beacon 2, leaving room for expansion. (These greases are suitable for temperatures between -30C and +110C).

If a rumble, knock or scrape is heard the motor should be replaced or examined and repaired by an electric motor repair specialist.

NEVER subject the shaft to hard blows, as this may cause damage to the bearings resulting in noisy running and reduced life.

#### MOTORS WITHOUT GREASE POINTS

Remove belts, run motor and apply the tip of a screwdriver to motor body (not shaft!) and the handle to your ear. A purring sound should be heard. If a squeaking noise is heard the bearing is dry and should be cleaned and flushed, out with a mixture of Tuoline and methylated alcohol (or, in an emergency, white spirit, never petroleum or paraffin).

#### MOTOR OVERHEATING

Check for overheating, ascertain cause and rectify.

#### WASHABLE FILTERS

Wash in mild detergent, rinse and squeeze dry.

**AUTOROLL FILTERS** Check oil level in gear box, lightly oil chain drive, lubricate drive motor, oil end of roll indicator arm.

#### ACTIVATED CARBON (constantly monitored)

When gas absorption drops below limiting level remove, replace with spare set and send laden set for reactivation or discard.

#### ACTIVATED CARBON (disposable non-monitored).

After 1 month usage remove test element or one cell (install new cell) and send for analysis and prediction of remaining life.

Replace filters completely within predicted period.

#### ELECTRIC HEATERS

Particularly check condition of wiring and insulation, plus surrounding paintwork/metalwork for signs of overheating.

#### DAMPERS- MOTORS

Lightly oil damper and motor bearings and link swivels - except nylon bearings.

#### COILS - GENERAL

Check finned surfaces every 6 months for build up of dirt or lint. If required wash down with mild detergent solution and soft brush and blow out any solids between fins with compressed air line. Take care not to disturb the fin surfaces or probe the coils with metal scraper as damage may cause leaks.

At six monthly intervals ensure that the condensate drain lines are unobstructed and functioning.

#### DX COOLING COILS

During winter the refrigerant should be pumped over into the liquid receiver and the isolating valve shut. Enough gas should be left in the system to keep a positive pressure in it. Before restarting, the plant should be checked for refrigerant leaks.

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## 6. Maintenance

### 6.2 Maintenance Action (not already indicated in Schedule)

#### PLATE HEAT EXCHANGERS

Only periodic visual checks are necessary. If dampers are fitted, test their movement. After initial 3-monthly inspection intervals, checks can be carried out every 12 months.

Based on long experience, dirt build up inside the heat plate exchangers installed in air handling equipment is not expected. Yet should dirt enter the plate heat exchanger when used for special applications, e.g. welding shops, paint shops, kitchen extracts etc., the heat exchanger package can be cleaned as follows.

Remove dust and fibres with a soft brush or with a vacuum cleaner. Take care when cleaning with compressed air that the exchanger package is not damaged. Keed at a distance.

Oils, solutions etc. can be removed with hot water or grease solvents, by washing or immersing.

Cleaning with high pressure devices is possible if:

- a flat nozzle 40° is used
- The maximum water pressure is 100 bar

#### Note

When cleaning take care that the heat exchanger is not damaged, neither mechanically or chemically:

- Choose harmless cleaning agents.
  - Clean carefully. The material thickness is only 0.125 or 0.15 mm!
-

## 7. Fault Finding

Note: check for broken wires or loose cable shoes first, also at control panel

ITEM OF EQUIPMENT	FAULT	CHECK
7.1 CENTRIFUGAL FANS	NO AIR FLOW - Fan motor stationery - No current to motor	Motor connected Wiring to isolator (on?) Fuses intact Wiring to starter (on?) Starter wired properly Overloads holding in and correct size Wiring to time clock at 'on phase' Wiring to panel / mains (on?) Other control circuits holding fan(s) off (e.g. gas fired heater warm up)
	NO AIR FLOW - Fan motor stationery - Current to motor	Jammed impeller Seized fan / motor bearings Drive belts too tight Motor windings / wiring faulty Motor wrongly connected Wrong voltage
	NO AIR FLOW - Fan motor running - Fan stationery	Jammed impeller Drive belts loose or missing Impeller loose
	NO AIR FLOW - Fan running	Louvres blocked VCD's closed Filters blocked Cooling coil frozen solid Duct blocked Fire damper link failed Grilles closed
	LOW AIR FLOW	Check as for no air flow plus:- Fan rotation incorrect Filters back to front Media wrong Drive belts slack or greasy Pulley ratios wrong Duct resistance exceeds design Duct leaking on pressure side Access doors off Duct Joint not sealed
	HIGH AIR FLOW	Low initial clean filter resistance filter missing duct incomplete or leaking pulley ratios wrong backward bladed impeller installed as forward System resistance over estimated
	MOTOR CURRENT EXCEEDS NAMEPLATE F.L.C.	Check as for no airflow, low air flow, high air flow
7.2 ELECTRIC HEATERS	NO HEAT	All controls, protective devices and interlocks as described in 'Commissioning' section are installed Thermostat setting too low Time clock at 'on' phase Filters clean Airflow adequate Isolator connected Mains switch on Power from mains

## 7. Fault Finding

Note: check for broken wires or loose cable shoes first, also at control panel

ITEM OF EQUIPMENT	FAULT	CHECK
7.2 ELECTRIC HEATERS cont'd	NO HEAT cont'd	All wiring connected High temperature cut out button in Continuity across H.T. cut out terminals Airflow switch making and breaking Voltage to airflow switch terminals Contactor coil functioning properly Fuses not blown Step controller functioning properly Fan - EAHB interlock functioning properly  If low airflow refer to 'Low Airflow' centrifugal fan section  Note:- If the high temperature cut out has operated do no run system until reason for 'cut out' has been found.
	LOW HEAT	Wrong elements supplied Element failure (open circuit or down to earth) Elements disconnected Elements incorrectly wired Wrong voltage Thermostat too low Step controller sticking / faulty Wiring fault Other controller equipment fault
7.3 COOLING COILS	NO COOLING -current to plant	Thermostat setting too high / faulty Time clock at 'on' phase Motor not connected Overloads tripped (continue checks as for low airflow in 'fans')
	NO COOLING -HP cut out functioning	Correct setting Faulty condenser Heat rejection faulty Fans and pumps stopped Condenser blocked
	LOW OR NO COOLING -LP cut out functioning	Suction pressure / evaporating temperature too low Coil freezing up Condenser too large for evaporator Low air flow Uneven air flow Low entering air temperature Humidistat(s) calling for dehumidification Low compressor capacity control installed and functioning
	NO COOLING -chilled water Isolating valve closed	Thermostatic valves closed Thermostat failure Circulating pump failure
	NO COOLING -LP cutout functioning Expansion valve Freezing	Water in system
	LOW COOLING -fridge plant cycles	Low load (unloader) compressor capacity control functioning Step controller functioning Other modulating controls functioning

## 7. Fault Finding

Note: check for broken wires or loose cable shoes first, also at control panel

ITEM OF EQUIPMENT	FAULT	CHECK
7.3 COOLING COILS cont'd	HIGH RH	Humidistat or dewpoint stat too high/faulty No cooling Coil fault (see above) Entering air temperature too high Insufficient cooling capacity (maybe start up, pull down time) Excessive fresh air or airflow Excessive moisture gain Moisture carryover
	LOW RH	Stat too low/faulty Coolant too cold Refrigerant plant capacity too high Inadequate controls Insufficient airflow
	COIL SWEATING	Blocked filters Blocked coil face Air on dewpoint condition higher than design Chilled water flow temperature or DX evaporating temperature lower than design
	MOISTURE CARRY OVER FROM FINS (or past eliminators if fitted)	Check as for 'coil sweating' High volume Uneven face velocity Eliminators omitted in error
	MOISTURE CARRY OVER FROM DRAIN TRAY (or drain tray not emptying or leaking)	Horizontal Undamaged Drain tray outlet to U-trap not blocked Primed adequate differential U-trap drain Adequately sized correctly pitched condense line dropping into open tundish Upstream restricted airflow causing depression at coil greater than U-bend differential Cover plates leaking air on bolt on coils
7.4 HEATING COILS	NO HEAT	Thermostat too low/faulty Time clock at 'on' phase/faulty Pump failure Boiler plant off Automatic valve closed due to thermostat Valve transformer failure Isolating valves closed Airlock
	LOW HEAT	Check Flow and return temperature - if low check boiler plant and controls Check flow rate - if low check:- Regulating valves open Insufficient pump head Piping sizing wrong Blockage in coil or high coil resistance (check temperature change across coil and equal tube temperatures) Warm up time adequate

## 7. Fault Finding

Note: check for broken wires or loose cable shoes first, also at control panel

ITEM OF EQUIPMENT	FAULT	CHECK
7.5 HEAD PRESSURE TOO REFRIGERATION HIGH		Refrigerant overcharge - vent excess charge Air in system - leak test, repair leak, evacuate and recharge Dirty Condenser- clean Malfunction of condenser fan (air cooled) - check head pressure speed control if fitted Restricted water flow - check flow rate and adjust Water on temperature too high - cooling tower operation Blockage in discharge pipework - check and replace damaged section(s). evacuate and recharge High air temperature entering condenser (air cooled) - spill over between adjacent condensers, fit baffle or resite condensers
	LOW HEAD PRESSURE	Refrigerant under charge - leak test, add refrigerant if necessary Over condensing - Fan speed too high (air cooled), water flow too high (water cooled) Faulty valves Low external ambient - pre heat air to cooled condenser Low back pressure
	HIGH BACK PRESSURE	Air flow too high - adjust belt drive as necessary Room temperature or air on too high - adjust thermostat Faulty expansion valve Also see - 'Head pressure too high' above
	LOW BACK PRESSURE	Air flow too low - adjust belt drive as necessary Filters dirty Shortage of refrigerant - leak test. add refrigerant as necessary Faulty valves Blockage in pipe - check and replace damaged section(s). evacuate and recharge
	SUCTION LINE SWEATING BACK TO COMPRESSOR	Expansion valve open too wide

## 7.6 Fan Drive Belts

PROBABLE CAUSES		REMEDY	
Excessive oil	●	Lubricate properly	●
Exposure to elements	●	Clean pulleys & belt(s)	●
Belt forced over pulley rim	●	Replace belt(s)	●
Contact with obstruction	●	Provide protection	●
Insufficient tension	●	Install properly	●
Stalled driven pulley	●	Check for belt length	●
Excessive slip	●	Remove obstruction	●
Rough pulleys	●	Tension properly	●
Substandard pulleys	●	Free pulleys	●
Excessive tension	●	Replace pulleys	●
Shock load	●	File smooth	●
Foreign material	●	Redesign drive	●
Excessive dust	●	Operate properly	●
Drive misalignment	●	Align drive	●
Worn pulley grooves	●	Provide ventilation	●
Excessive vibration	●	Check for proper belt(s)	●
High ambient temperature	●	Check machinery	●
Excessive tension	●	Use only new belts	●
Drive underbeltd	●	Use single source	●
Damaged tensile member	●		
Incorrect belts	●		
Incorrect drive set up	●		
Insufficient take up	●		
Improper matching	●		
Mixed old and new belts	●		
Non parallel shafts	●		
Different manufacturers	●		